



## Oral strength in subjects with a unilateral cleft lip and palate



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### ABSTRACT

**Purpose:** Facial appearance and speech outcome may affect psychosocial functioning in girls and boys. Several studies reported dissatisfaction with facial appearance and more specifically the lip and mouth profile in children with cleft lip and palate (CLP). The purpose of this controlled study was to measure the tongue and lip strength and endurance in boys and girls with CLP.

**Methods:** Twenty-five subjects (mean age: 10.6 years) with a unilateral CLP and a gender- and age-matched control group were selected. All subjects with an unilateral CLP consulted the same craniofacial team and had undergone an identical surgical procedure. Surgical procedure of the lip was performed using a modified Millard technique without primary nose correction at an average age of 5.5 months. The Iowa Oral Performance instrument was used to measure lip and tongue strength and tongue endurance. **Results:** The results of the Iowa Oral Performance measurement showed no significant differences between the subjects with an unilateral cleft lip and palate and the age and gender matched control group without a cleft lip and palate.

**Conclusion:** There is no significant differences regarding oral strength more specifically the lip and tongue strength and endurance between subjects with and without an unilateral cleft lip and palate. ENT specialists and speech pathologists must be aware of this aspect of the normal lip and tongue functions.

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### Introduction

Facial appearance and speech outcome may affect psychosocial functioning [1] in girls and boys. Several studies reported dissatisfaction with facial appearance [1–4] and more specifically the lip and mouth profile [5–10] in children with cleft lip and palate. An appropriate lip and also tongue function is essential for facial aesthetics (e.g., lip competence, interdental tongue behavior), speech production and non-verbal functions like chewing, swallowing and facial emotional readability. Few authors assessed oral strength in children with cleft lip and palate. Table 1 provides a summary of recent studies regarding lip strength in children with cleft lip and palate.

Several studies reported restrictions and/or compensatory behavior in upper lip or nasolabial movements [11–15] and one study [11] mentioned variable interlip coupling. Some of these studies were performed in specific controlled test situations with

for example the use of a midsagittal articulograph [11] or the use of an instrument with an interdental yoke and lip saddle [13]. Moreover, small control groups [11] or no age- [12,15] and gender-matched [11,12] control groups were used. Studies clearly identifying specific outcome measures in both boys and girls with clefts regarding oral strength have the power to evaluate cleft related surgical techniques (e.g., the type and timing of primary lip closure and revisions of the lip repair). The purpose of this controlled study was to measure the tongue and lip strength and endurance using the Iowa Oral Performance Instrument (IOP) [17] in boys and girls with unilateral cleft lip and palate (CLP). Assessment of the lip function is necessary to evaluate the surgical procedure of the lip. All patients were treated by the craniofacial team of the Ghent University Hospital. Based on the results of previous reports in the literature, a decreased lip strength was hypothesized in subjects with clefts compared with subjects without a cleft.

### Methods and materials

This study was approved by the Human Subject Committee of the Ghent University (B670201215561).

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## Subjects

Twenty-five Flemish with CLP subjects responded positively to an invitation to participate in this study. They ranged in age from 6 to 17.9 years with a mean age of 10.6 years. Only subjects with non-syndromic unilateral or bilateral CLP, no secondary pharyngeal

surgery, no cognitive deficiency, no neuromotor dysfunction or residual hard palate fistula and no acute nose, ear and throat diseases were invited. The subjects in the experimental group included 17 boys and 8 girls. All subjects with a unilateral CLP consulted the same craniofacial team and had undergone an identical surgical procedure. Surgical procedure of the lip was

**Table 1**

Summary of recent studies regarding the lip functions in children with cleft lip (and palate). CLP: cleft lip and palate, CL: cleft lip, U/BCLP: unilateral/bilateral cleft lip and palate; m.a.: mean age

Authors	Patients	Purpose	Methods	Important results
van Lieshout et al., 2002 [11]	9 CLP/m.a.: 15.8 years 3 boys, 6 girls 4 controls/m.a.: 17.8 years 2 boys, 2 girls	1. Functional assessment of potential differences in upper and lower lip kinematics and lip coupling.	Midsagittal articulography was used during non-verbal and verbal tasks.	<ol style="list-style-type: none"> <li>1. Reduced upper lip movement ranges.</li> <li>2. Variable spatiotemporal pattern for upper lip movement cycles.</li> <li>3. More variable interlip coupling.</li> <li>4. Linguistically more complex tasks showed more variability in the individual upper and lower lip movement.</li> </ol>
Trotman et al., 2005 [12]	16 CLP/m.a.: 13.4 years 12 UCLP, 4 BCLP 8 boys, 8 girls 8 controls/m.a.: 10.5 years 4 boys, 4 girls	1. Statistically analyzing facial movement data.	Video recordings and measurements in three dimensions of facial movement (smile, cheek puff, grimace, lip purse, mouth opening).	<ol style="list-style-type: none"> <li>1. Compensatory movements were seen in some patients with CLP more specifically a restricted antero-posterior movement of the upper lip.</li> <li>2. Greater movement of the lower lip and chin regions to compensate for this upper lip impairment.</li> </ol>
Trotman et al., 2007 [13]	42 CL/m.a.: 13.3 years 12 boys, 30 girls 31 controls/m.a.: 13.4 years 14 boys, 17 girls	1. To investigate lip force dynamics.	Measurement of fine motor control and compressions forces with upper and lower lip using an interdental yoke with lip saddle.	<ol style="list-style-type: none"> <li>1. Subjects with a cleft of the upper lip had increased contraction instability and elevated force recruitment rates of the lower lip.</li> <li>2. A reduction in on-target force behavior and degradation in force control.</li> </ol>
Trotman et al., 2007 [14]	32 CL (nonrevision CL) m.a.: 12.4 years 21 boys, 11 girls 31 CL (revision CL) m.a.: 12.1 years 18 boys, 13 girls 37 controls/m.a.: 13.1 years 20 boys, 17 girls	1. To measure nasolabial movements in subjects with CLP.	Three-dimensional movements were assessed using a video-based tracking system (38 landmarks) during maximum smile, cheek puff, lip purse, mouth opening and natural smile.	<ol style="list-style-type: none"> <li>1. Lateral movements of the upper lip were greater than vertical movements.</li> <li>2. The revision and nonrevision groups demonstrated 6–28% less upper lip movements (most restriction for smiling and greater asymmetry in upper lip movement).</li> </ol>
Trotman et al., 2013 [15]	15 unrepaired CLP m.a.: 3.20 months 9 boys, 6 girls 16 controls/m.a.: 4.25 months 10 boys, 6 girls	<ol style="list-style-type: none"> <li>1. To collect dynamic facial images.</li> <li>2. To determine differences in facial movement.</li> <li>3. To determine changes in facial movements before and after primary lip repair.</li> </ol>	Seven measures of facial movement before and 4 months after primary lip repair in CLP subjects and at similar time points in the control group.	<ol style="list-style-type: none"> <li>1. The range of facial movements increased by 17% for all infants during the 4-month period.</li> <li>2. Subjects with UCLP had 50% less nasolabial movement and no difference due to lip repair.</li> <li>3. Subjects with U/B CLP had 58% and 118% greater lateral upper lip movement respectively.</li> <li>4. Subjects with UCLP had 3.67 and BCLP 3.56 times greater asymmetry of movement before lip repair. Less problems after lip repair.</li> </ol>
Nakatsuka et al., 2011 [16]	15 CLP/m.a.: 11.3 years 1 UCL, 5 UCLA, 9UCLP 8 boys, 7 girls 15 controls/m.a.: 10.2 years 8 boys, 7 girls	1. To estimate effects of lip repair on the multidirectional lip-closing forces during maximum pursing-like lip-closing movement.	A multidirectional lip-closing force measurement system.	<ol style="list-style-type: none"> <li>1. Identical forces were measured in all directions.</li> <li>2. Identical total lip-closing forces were measured.</li> <li>3. The vertical and oblique lip-closing forces are different between the cleft and the non-cleft side.</li> </ol>

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