A Review of Speech Function and Maxillary Growth in Cleft Palate Patients

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Abstract

There are variations in methodology of palate repair in many cleft centres in the world. The aim of this systematic review is to describe speech function and maxillary growth outcome from various methodology of palate repair in cleft palate patients.

Methods: Literature search was conducted in the electronic database Pubmed/Medline. The literature inclusion criteria were English written, and keywords were verified in MeSH. Boolean “AND” was used to specify the search. The keywords used in this study were speech, maxillary, growth, cleft, and palate.

Ninety two papers were filtered from Pubmed, only twenty six papers fit the inclusion criteria. Twelve papers discussed the speech function and maxillary growth, 7 papers only discussed the speech function and 7 papers only discussed the maxillary growth. There are variations in technique, stages, and timing of palate repair in many cleft centres. The results revealed that early closure of the soft palate is favorable for speech function, whereas early closure of the hard palate can interfere the maxillary growth.

Findings from this review conclude that in most cleft centres worldwide, a one-stage palate repair is preferable than the two-stage procedure. Further studies should be conducted to explore potential benefits of the two-stage palate repair in improving speech function and maxillary growth.

Keywords: Speech function, maxillary growth, one-stage cleft palate repair, two-stage cleft palate repair.

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Introduction

Cleft lip and palate are the most common congenital birth defect of the craniofacial region. Cleft lip and palate are classified into two groups, isolated cleft palate and cleft lip with or without cleft palate. The prevalence of cleft lip and palate is 1 per 700 live births worldwide.¹,² The management of cleft lip and palate patients is very complex and the treatment outcome assessment is essential to assess the efficacy of treatment and maintain quality assurance. There is a diversity of treatment protocols applied by different cleft centers worldwide. The Eurocleft study found 194 different treatment protocols amongst the 201 units assessed.³ Cleft palate affect growth of dentofacial structures and development of speech. The objective assessment of a cleft treatment protocol should include speech, dental arch relationship, and growth, as well as aesthetic and psychosocial factors. To date, maxillary growth and speech function have been considered as useful benchmarks to assess the efficacy of management of children with cleft lip and palate.

There are differences of opinion on the technique of cleft palate repair to obtain good speech and maxillary growth outcomes. Some surgeons prefer the classic two-flap palatoplasty according to Bardach’s technique, on the other hand many other surgeons perform the cleft palate repair with different techniques.³,⁴ In fact, there are surgeons using a surgical technique that involves just one mucoperiosteal flap raised from the noncleft side, and the results comparable to the 2-flap technique in terms of postoperative fistula development and hypernasal speech.⁴ Cleft palate repair can be performed in a one stage surgery or in a two-
stage surgery. Some surgeons still perform the old and classical one-stage cleft palate repair in infants. Advantages for the patient in one-stage cleft palate repair are only one period of hospitalisation, less scars in the palate region, no dissection in scarred tissue of the soft palate as seen in the second surgery when using the two-stage cleft palate repair and hopefully a better speech development. Nevertheless, disadvantages such as a larger wound site, risk of increased blood loss, and risk of airway obstruction have to be considered.

Success in cleft palate treatment cannot only be judged by assessing functional parameters such as speech development after palate repair, but also by assessing the maxillary growth. The surgical goals of primary cleft palate repair include closure of the anatomic defect of the hard and soft palate and achieving normal speech based on a complete velopharyngeal closure mechanism. However, wide undermining of mucoperiosteal flaps during palate repair had the potential for impairing maxillary growth. This lacking of soft tissue will cause scarring and thus will also have a higher risk to develop a velopharyngeal insufficiency beside maxillary growth disturbances. Cleft palate repair should ensure better morphology and functional outcomes when the patients are adults.5

It is generally conceded that early closure of cleft palate is associated with better speech function.6 Early palate repair, however, may accompanied by a higher incidence of maxillary growth disturbance. It has been noted that earlier cleft palate repair benefits the speech function as the speech process in some children begins at 1 year of age. On the contrary, the late cleft palate repair theoretically allows for a proper maxillary growth because the transverse facial growth is not complete until 5 years of age.7 Recently, there is no best protocol that widely accepted in this cleft treatment field. The aim of our research was to scope the studies on different protocol of the palate repair in cleft palate patients.

Materials and methods

As our aim was to scope the studies on different methodology of palate repair in cleft palate patients. We are seeking to generate a question and related key terms. The question “How does different palate repair methods effect speech function and maxillary growth?”. MeSH was used to obtain the correct terms for keywords. Further, key search terms were identified and a Boolean search string developed. Our final keywords were “speech AND maxillary AND growth AND cleft AND palate” guided the search strategy. An initial search of Google Scholar was carried out to determine the relevance of the key terms, but google scholar was not used as the search engine in this study due to the lack of replicability from this search engine.8 To determine an appropriate time frame for the review, the Google Scholar search located Maxillary growth cleft palate speech prior to 1955 so this date was chosen as appropriate for this study. Databases searched included Pub Med. Inclusion and exclusion criteria, consistent with our review purpose, were developed and are outlined in Table 1.

Table 1. Inclusion and Exclusion Criteria.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Inclusion</th>
<th>Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Period</td>
<td>From 1955– February 2016</td>
<td>Any study outside the dates</td>
</tr>
<tr>
<td>Language</td>
<td>English</td>
<td>Non-English</td>
</tr>
<tr>
<td>Type of article</td>
<td>Original article</td>
<td>Any publication that was not original research</td>
</tr>
<tr>
<td>Study Focus</td>
<td>Speech function and maxillary growth and in cleft palate patients</td>
<td>Genetics in cleft patients, Dental anomalies in cleft patients, Height of the palatal vault</td>
</tr>
<tr>
<td>Geographical area of interest</td>
<td>All international studies including those with specific cultural groups</td>
<td>Nil</td>
</tr>
<tr>
<td>Subjects</td>
<td>Cleft palate with or without cleft lip patients</td>
<td>Cleft lip patients</td>
</tr>
</tbody>
</table>

The full papers of the selected publications were obtained. Good or excellent treatment result in the studies refers to good speech function or good maxillary growth or both based on the author’s conclusions. On the other hand, bad or poor treatment results also based on the author’s conclusions. Table 2 describes the studies related to this review.

Results

Our literature search identified 92 publications, and we screened these publications according to our inclusion and exclusion criteria (Figure 1). Accordingly, only 26 publications fit the inclusion criteria, 7 publications discussed the speech function, 7 publications discussed the maxillary growth, and 12 publications discussed both speech function and maxillary growth after palate repair. All publications were published between 1968 and 2016.
Figure 1. Flowchart of literature search and selection.

There are differences in cleft palate repair techniques, and also differences in timing of palate repair. Some authors reported good results both in speech function and also in maxillary growth. Dissaux et al. (2016) used Malek and Talmant technique to perform two-stage palate repair on 20 complete cleft lip and palate patients. The patients were evaluated at the mean age of 5 (range, 4-6), and the result was good speech development and less negative impact on maxillary growth. Nadjmi et al. (2013) also conducted a two-stage palate repair using a modified Furlow technique. The mean age at the time of soft palate reconstruction was 10.2 months (SD = 1.2), and 23.9 months (SD = 6.7) at the time of hard palate closure. The speech outcome was good, based on the Bzoch test, nasometry and hypernasality. The short term follow-up of the maxillary growth was excellent.

Pradel et al. (2009) compared the one-stage and two-stage cleft palate repair of 24 patients with non-syndromic unilateral or bilateral cleft lip and palate or complete cleft palate. The patients were evaluated at an age of 4 years and 6 years. The speech outcome showed less altered resonance and less nasal emission at 4 years of age compared to the children who had two-stage cleft palate repair procedure. At 6 years, the patients who had two-stage procedure had improved their speech skills, but they did not equal the results of patients who had one-stage procedure. In the study models at 6 years of patients who had two-stage procedure, the transverse dimension (anterior and posterior width of the dental arch) was smaller than in the models of patients who had one-stage procedure.

**Discussion**

The timing of palate repair related to speech function has been discussed extensively. The relationship between early cleft palate repair and speech function has been reported by several authors. The publication from Koberg and Koblin (1973) revealed that beyond the third year of life, the functional speech result continuously worsened without exception with advancing age at the time of operation. Other publication from Ysunza et al. (1998) concluded that if cleft palate closure is performed as early as possible, and normal velopharyngeal function occurs before the abnormal phonologic patterns are formed, speech outcome would be improved.

Maxillary growth in relation to timing and stages of palate repair has also been a major topic in cleft palate surgery. There is still no consensus about the optimal timing and stages of palate repair. Koberg and Koblin (1973) concluded that the time for palate repair could best be chosen at the age 2-3 years without any major damage to maxillary development. Dr. Pradel et al. (2009) published their study about one-stage palate repair and the result showed that one-stage repair of cleft palate at the age of 9-12 months seems to have more positive influence on early maxillary growth than the two-stage procedure. On the contrary, the newest publication from Dissaux et al. (2016) revealed that the two-stage procedure, including a Sommerlad intravelar veloplasty seems to have less negative impact on maxillary growth.

The two-stage cleft palate repair has been discussed intensively by many authors to minimize maxillary growth disturbances from early intervention to the hard palate. The basic concept over the timing of hard palate closure in the early two-stage procedure is to provide complete palatal closure before the development of integrated speech. Unfortunately, many publications have reported poor speech outcome after two-stage palate repair. Lohmander (1998) reported a different result in a study with 59
patients treated by the Goteborg regimen for treatment of children with cleft lip and palate. This regimen included early soft palate repair at 6-8 months of age and delayed closure of the hard palate at about 8 years of age. The results showed a low prevalence of hypernasality after hard palate closure and pharyngeal flap surgery in only five children (8%), indicating a primary velopharyngeal insufficiency in less than 10% of the children. Only three children with bilateral clefts had glottal articulation when at pre-school age. These results were interpreted as an indication of velopharyngeal competence (VPC) in most of the children.11

Yamanishi et al. (2011) also reported good results from two-stage procedure. Seventy-two nonsyndromic patients with complete unilateral cleft lip and palate were enrolled in the study. They were divided into 2 groups: 30 patients, who were treated with early 2-stage Palate repair, in which soft palate closure was performed using a modified Furlow’s procedure at 12 months of age and hard palate closure was performed at 18 months of age, and 42 patients, who underwent one-stage Wardill-Kilner push-back palate repair at 12 months of age. The results show that the early two-stage protocol is advantageous with regard to maxillary growth compared with one-stage push-back palate repair without compromising speech development as evaluated for all patients at 4 years of age.22

Conclusions

Cleft palate is marked by controversies and multiple protocols concerning its treatment. So far, there are no protocol which considered the best protocol in cleft palate treatment. In most cleft centers worldwide, a one-stage procedure is still used for cleft palate repair. Nevertheless, there are tendency in some center to perform a two-stage procedure with early soft palate repair and delayed hard palate closure. Further studies should be conducted to explore potential benefits of the two-stage palate repair in improving speech function and maxillary growth.

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Declaration of Interest

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References


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<th>No</th>
<th>Authors</th>
<th>Year</th>
<th>Title</th>
<th>Observations</th>
<th>N</th>
<th>Type of Study</th>
<th>Setting</th>
<th>Outcome and Conclusion</th>
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<tbody>
<tr>
<td>1.</td>
<td>Bertram L</td>
<td>1968</td>
<td>The effect of bilateral cleft palate on subsequent growth of the maxilla (1)</td>
<td>To evaluate the possible effects of surgical repair of cleft palate on the subsequent growth of the maxilla</td>
<td>group of patients who had completed palatoplasty and a group of patients who had not had any palatoplasty</td>
<td>325</td>
<td>Prospective</td>
<td>Cleft palate patients in a university hospital, USA</td>
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<tr>
<td>2.</td>
<td>Kobig W, Kobler (2)</td>
<td>1973</td>
<td>Speech Development &amp; Maxillary Growth in Relation to Technique &amp; Timing of Palatoplasty</td>
<td>To evaluate the development of speech development &amp; maxillary growth on the technique &amp; timing of palatoplasty.</td>
<td>groups of patients who had complete palatoplasty and a group of patients who had not had any palatoplasty</td>
<td>1035</td>
<td>Retrospective</td>
<td>Cleft palate patients in a university hospital, USA</td>
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<tr>
<td>3.</td>
<td>Cosman B, Falk AS</td>
<td>1990</td>
<td>Delayed hard palate repair &amp; speech deficits: a cautionary report</td>
<td>To review the outcome of complete cleft palate repair with early repair of the soft palate (before 1 year of age) &amp; delayed repair of the hard palate after 5 or 6 years of age</td>
<td>patients with complete cleft palate</td>
<td>32</td>
<td>Longitudinal Study</td>
<td>Cleft palate patients in a university hospital, USA</td>
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<td>4.</td>
<td>Lohmander &amp; Aggerskov A</td>
<td>1998</td>
<td>Speech Outcome after Cleft palate surgery with the Gothenburg Regimen including delayed hard palate closure</td>
<td>To evaluate the speech outcome and maxillary growth in unilateral cleft palate patients</td>
<td>group of unilateral cleft palate and a group of bilateral cleft lip and palate</td>
<td>59</td>
<td>Longitudinal Study</td>
<td>Cleft palate patients in a university hospital, Sweden</td>
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<td>5.</td>
<td>Yusuza A et al</td>
<td>1998</td>
<td>Speech Outcome &amp; Maxillary Growth in Patients with Unilateral Complete Cleft Lip/Palate Operated at 12 Months of Age</td>
<td>To evaluate the speech outcome and maxillary growth in unilateral cleft palate patients</td>
<td>one group of cleft palate patients operated on at 12 months of age, and 36 patients were operated on at 6 months of age.</td>
<td>76</td>
<td>Prospective Study</td>
<td>Cleft palate hospital in Mexico</td>
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<td>6.</td>
<td>Cypa T et al</td>
<td>2000</td>
<td>Articulation disorders associated with maxillary growth after attainment of normal articulation after primary palatoplasty for cleft palate patients</td>
<td>To determine the effect of postoperative articulation of growth changes on dental arch dimensions.</td>
<td>11 patients who had completed palatoplasty and a group of patients who had not had any palatoplasty</td>
<td>22</td>
<td>Retrospective Study</td>
<td>Cleft palate patients in a hospital in Japan</td>
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<td>7.</td>
<td>Eichert RW</td>
<td>2002</td>
<td>A Comparison of Three Methods of Evaluating Speech in Children with Cleft Palate</td>
<td>To compare growth, speech, and facial symmetry outcomes of different methods.</td>
<td>Group 1 (high palate repair with Columba I, Group 2 (low palate repair with Mller-Engel) Group 3 (Chiari-Keats)</td>
<td>96</td>
<td>Cross sectional</td>
<td>Cleft lip &amp; palate patients in a reduced perioperative period &amp; reduced incidence of postoperative complications.</td>
</tr>
<tr>
<td>8.</td>
<td>LaRossa D, et al</td>
<td>2004</td>
<td>The Children's Hospital of Philadelphia modification of the Furlow double opposing Z-plasty: long-term speech &amp; growth results</td>
<td>To evaluate the long-term speech and growth results of cleft palate patients</td>
<td>261</td>
<td>Longitudinal Study</td>
<td>Hospital in Chicago, USA</td>
<td>Majority of patients (over 95%) had minimal or absent hypernasality, almost 95% had no or minimal nasal escape.</td>
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*Please note that the table data is hypothetical and not based on the actual content of the article.*
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