Effect of Veau-Wardill-Kilner Type of Cleft Palate Repair on Long-Term Midfacial Growth


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There is a common concern that the Veau-Wardill-Kilner type of cleft palate repair causes extensive denudation of the palate, resulting in inhibition of maxillary growth. The evidence for this belief is equivocal in the literature. The authors present some long-term results of this technique from a pure sample of nonsyndromic complete unilateral cleft lip and palate patients operated on by a single intermediate-volume cleft surgeon over a period of 25 years. Twenty-five patients, all born between 1977 and 1989, met the above inclusion criteria. Their age at the time of collection of study models and cephalograms was 9 to 17 years (average, 12 years). Midfacial growth was studied using 12-year dental models and lateral cephalograms taken before definitive orthodontic treatment. These were evaluated using the GOSLON Yardstick and digital cephalometric analysis. The final GOSLON results show that 72 percent of the patients had a good or satisfactory outcome, with a GOSLON score of 1, 2, or 3, and only 28 percent ended with a poor score of 4 or 5. The poor sensitivity of cephalometrics in discerning statistically significant differences was highlighted by the huge overlaps observed in the 95 percent confidence interval graph of mean sella-nasion-subspinale angle (S-N-A) values when comparing the results of the Eurocleft centers with those of the authors’ center. The results suggest that satisfactory long-term midfacial growth can be obtained with Veau-Wardill-Kilner cleft palate repair. (Plast. Reconstr. Surg. 111: 576, 2003.)

The relative paucity of large, long-term studies of cleft lip/palate outcomes is a reflection of the very small number of large-volume cleft centers operating within fixed protocols and undertaking regular audit. The best results in terms of maxillofacial growth to date have come from centers in Oslo, North East Thames, Brussels, and Marburg, none of which use Veau flap repairs. This, coupled with poor results for maxillofacial growth from centers using Veau flap repairs, have led some to consider this a traumatic palatoplasty, though the evidence for this remains doubtful.

The senior author (R.McD.) has used the Veau-Wardill-Kilner repair with muscle pushback for the past 25 years, and these patients form a pure sample group ideal for studying the long-term effect of this repair on midfacial growth. The outcome measures used in our study are based on those published in the Eurocleft and Clinical Standards Advisory Group studies.

PATIENTS AND METHODS

Cohort

This retrospective study included patients born between 1977 and 1989. Only those who had a nonsyndromic unilateral complete cleft lip and palate operated on by a single surgeon (R.McD.) using the same technique for all the lip and palate repairs were included in this study. This surgeon performs approximately 20 to 30 primary cleft repairs per year and, hence,
can be classified as an intermediate-volume cleft surgeon. Our center provides cleft care for the whole of the old Wessex region in the United Kingdom (population: approximately 3 million). Although three cleft surgeons in this center performed cleft surgery during the study period, this study included only a single surgeon to reduce the compounding factors to a minimum.

Of the 100 patients with unilateral cleft lip and palate under the senior author’s care during this period, two had syndromic disorder, 63 had incomplete disorder, eight had been operated on by others, and in two patients the dental molds were unavailable (Fig. 1). A total of 25 patients, therefore, fulfilled all inclusion criteria mentioned above for the study. The ages of the patients at the time of the dental model collection and cephalograms were between 9 and 17 years (average, 12 years); 17 patients were male and eight were female. It should also be noted that all 25 patients included in the study had complete clefts in both bone and soft tissue.

The study group compares well in its characteristics with the Eurocleft study samples. The sample size in the Eurocleft study varied between 23 and 30 (three centers entered 23 patients each, two centers included 26 patients each, and only one center had a series of 30 study patients). The patients’ age at the time of collection of study models was 8 to 10 years, with an average age of 9 years (all patients were born between 1976 and 1979). The sex distribution ratios of the centers with a sample size of 26 (closest to our sample size of 25 patients) was 17 male to nine female, and 16 male to 10 female, respectively, which is very similar to our ratio of 17 male to eight female.

**Treatment Protocol**

None of the study patients underwent presurgical orthopedics. Lip closure was performed according to the Oslo protocol (Millard rotation advancement and anterior vomerine flaps) at 3 months of age. The Veau-Wardill-Kilner technique with muscle pushback was used to repair the cleft palate between the ages of 9 to 12 months. Alveolar bone grafting was undertaken between 9 and 13 years of age.

**Outcome Measures and Methods**

Midfacial growth was studied using 12-year dental models and lateral cephalograms taken before definitive orthodontic treatment. These were evaluated using the GOSLON Yardstick for denotalveolar relationships and cephalometric measurements for maxillary projections and skeletal patterns.

The GOSLON (Great Ormond Street, London, and Oslo, Norway) Yardstick is a clinical tool designed to rank the dental relationships in the late mixed or early permanent dentition.

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**Fig. 1.** Distribution of all of the unilateral cleft lip and palate cases, showing the final 25 cases that fulfilled the inclusion criteria.
stage into five discrete categories. Its use in the Eurocleft study and the Clinical Standards Advisory Group project in the United Kingdom has established it as a sensitive and reliable method of assessing dental arch relationships to compare different approaches to the early management of children with cleft lip and palate.6,7

Two consultant orthodontists assessed the 25 dental models in the study on two different occasions. The models were categorized into various groups using the master set of GOSLON reference models. Both assessors had attended the calibration course on the GOSLON Yardstick on a previous occasion. To remove any bias, one of the assessors selected was completely independent, having had no role to play in the clinical treatment of these patients. No discussion was allowed between the two examiners. Weighted kappa values were used to measure the strength of agreement.

The second outcome measure used in our study was cephalometric analysis based on the standard lateral cephalograms of these patients taken at 12 years of age before definitive orthodontic treatment. The Eurocleft study showed that the cephalometrics suffer from poor sensitivity in discerning statistically significant differences.8 The presence of multiple parameters in the cephalometric analysis also makes it difficult for the average reader to interpret the results. Hence, for simplification we elected to measure only the most important of these parameters: (1) sella-nasion-subspinale (S-N-A) angle, (2) sella-nasion-supramentale (S-N-B) angle, (3) S-N-A–S-N-B angle (A-N-B), and (4) skeletal patterns based on A-N-B.

These are also the parameters studied in the Clinical Standards Advisory Group project. All cephalograms were scanned and digitally analyzed by an independent maxillofacial surgery trainee surgeon using Steine-Tweed computer software. The software is used routinely in our maxillofacial department and has been tested for error in the past with no significant differences. For the purpose of this study, three cephalograms were scanned on two separate occasions to test the software and, again, no significant differences were found.

RESULTS

GOSLON

The GOSLON Yardstick ranks the dental models into five groups based on the anteroposterior arch relationships, vertical labial segment relationships, and transverse relationships.6 Groups 1 and 2 are considered excellent and good, group 3 as fair, group 4 as poor, and group 5 as very poor dentoalveolar relationships. Groups 1 and 2 may require simple orthodontic treatment or none at all. Group 3 will need complex orthodontic treatment to achieve a good result. Group 4 will often require orthognathic surgery to correct the skeletal mal-relationships, and group 5 will definitely require orthognathic surgery to correct the mal-relationships.

The final GOSLON results showed that 52 percent of the patients had a GOSLON of 1 or 2, indicating a good result; 20 percent had a GOSLON of 3, qualifying as a fair result; and only 28 percent ended with a poor score of 4 or 5. Thus, 72 percent of all patients had a good or satisfactory outcome in our series, based on these GOSLON scores (Table I).

The interexaminer and intraexaminer vari-

ances were analyzed using weighted kappa (κw) calculations and showed very good strength of agreement: interexaminer variation κw = 0.847; intraexaminer variation κw = 0.858 (first versus second assessment).

The comparison of our results with those published from the Eurocleft study showed our results to be midway between the best and the worst Eurocleft centers9 (Table II and Fig. 2). When compared with results published from the United Kingdom in the Clinical Standards Advisory Group report, our results are second best in the country2 (Fig. 3). The only other published U.K. series with long-term results is from Northern Ireland, with results similar to ours (28 percent GOSLON 4 and 5).10

CEPHALOMETRIC

The S-N-A angle is considered as a measure of the maxillary projection, and Figure 4 shows 95 percent confidence intervals of mean S-N-A values from the Eurocleft study and our center. It is evident from the graph that there are huge
overlaps; therefore, no conclusions can be drawn. The poor sensitivity of cephalometrics is evident because, despite differing mean values in similar sized samples, the 95 percent confidence intervals show huge overlaps (Table III).

The mean S-N-A, S-N-B, and A-N-B values in our study are shown in Table IV. Although the A-N-B mean values of the three best Eurocleft centers are better than our A-N-B mean of 0.4 degree, our value is still significantly better than the average U.K. A-N-B mean value of −0.4 degree, as published in the Clinical Standards Advisory Group report (Table V). The normal range of values for the S-N-A is 77.5 to 81.5 degrees, for the S-N-B it is 80 to 84 degrees, and for the A-N-B it is 1 to 4 degrees.

All cephalograms were classified into different skeletal patterns based on the A-N-B angles: (1) skeletal I: 2 to 4 degrees, (2) skeletal II: greater than 4 degrees, and (3) skeletal III: less than 2 degrees.

Based on the skeletal patterns, our results were similar to the average U.K. results (Table VI). The observed maxillary osteotomy rate in our series was 20 percent. All of the maxillary osteotomies were performed for orthodontically noncorrectable malocclusion and impaired facial profile.

**DISCUSSION**

Many authors have studied the multiple factors associated with facial growth outcome in cleft lip and palate patients. Facial growth in these patients has been the subject of intense discussion over many years. The lack of facial growth impairment in unoperated cleft lip and palate patients from India implies that the surgery is in some way damaging. These findings, however, were not completely supported by the results of Yoshida et al. (1992), in which a significant number of patients with unoperated cleft palates had relative maxillary retrusion when compared with those in the normal population with permanent dentition.

In 1969, Palmer et al. compared the results of muscle push-back and von Langenbeck palatoplasty. In their series of 93 patients, poor dentoalveolar results were observed in 62 percent of the muscle push-back group as compared with only 12 percent in the von Langenbeck group. The study, however, studied children at a very early age (median, 3.5 years); thus, no results with permanent dentition were presented. The lack of a reproducible scale such as GOSLON also makes it difficult to compare this study with more recent investigations.

Bishara et al. (1976) published their results from cephalometric comparison of Wardill-Kilner and von Langenbeck palatoplasty and found no statistical difference in the malocclusion or the maxillary growth between the two groups. This was in sharp contrast to the findings of Palmer et al. (1969).

The development of the GOSLON Yardstick has provided a reliable and reproducible means of measuring dental arch relationships and is a good predictor of those patients who will require corrective surgery. The Eurocleft study compared six major cleft centers and demonstrated very significant differences in GOSLON outcome, with the Oslo center having 57 percent in the favorable groups 1 and 2 and 6 percent of patients in the unfavorable groups 4 and 5. This contrasted markedly with the results from the Great Ormond Street center, where 31 percent of patients were in groups 1 and 2 and 33 percent were in groups 4 and 5. The surgical repair for unilateral complete cleft lip and palate in Oslo involved a Millard lip repair, with closure of the anterior palate using a lateral vomerine flap at the age of 3 months, followed by repair of the soft and hard palates using lateral von Langenbeck flaps at the age of 9 months. The Great Ormond Street group was treated by a wide variety of techniques. Indeed, the Eurocleft study attributed the different results to the organizational and surgical workloads and drew no conclusions regarding surgical techniques. Better organization and a higher volume of cleft surgery were associated with better GOSLON outcomes.

Subsequent studies from North East Thames, Brussels, and Marburg have dem-
onstrated good GOSLON outcomes. None of these centers use Veau flap repairs. In 1997, Hathorn et al. presented data from the Bristol center. The surgical protocol for the palatal closure in unilateral complete cleft lip and palate patients changed from Veau, to lateral von Langenbeck, to medial von Langenbeck over an approximately 20-year period. A single operator undertook most of the surgery. A highly significant improvement in GOSLON outcomes was noted, with Veau flaps performing poorest (13 percent in groups 1 and 2, 55 percent in groups 4 and 5) and medial von Langenbeck flaps performing the best (48 percent in groups 1 and 2, 28 percent in groups 4 and 5). This study, however, may reflect a long learning curve and an increase in the centralization and organization of cleft services in their center over the 20-year period of the study.

The cleft philosophy of the Delaire School is to avoid mucoperiosteal elevation of the hard palate in the outer two-thirds of the palate, and (when necessary) to use medially based von Langenbeck flaps, which avoid detachment of the greater palatine arteries from the palatal bones. This has been anecdotally reported to reduce maxillary growth disturbance. Recently,
Schendel et al. (1999) published a series of 95 patients who underwent Delaire palatoplasty over a 10-year period; sadly, no attempt was made to study their maxillary growth.¹⁸

Currently the best results come from Oslo and North East Thames. The Oslo group use lateral von Langenbeck flaps as described above. The only difference between this and the Veau flap elevation is a transverse incision in the anterior palate and the potential for more denudation of the anterior palatal bone with the increased scarring that may result. Throughout Europe, the Veau flap remains the most popular technique for hard palatal repair (22.7 percent of palatal repairs)¹⁹; likewise, in the United States it remains a popular form of palatal repair.

The results of this current study demonstrate that Veau flap repairs can be associated with an acceptable growth outcome. Not only the surgical volume and organization of the center, but also the experience and surgical skills of the operator, may influence the long-term facial growth of these patients. The technique itself may not be the most critical factor. Indeed, analyses of the various studies shows that different cleft centers obtain variable results.¹⁰

### TABLE IV
Mean Cephalometric Values of the Study Group*<br/>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Odstock Values</th>
<th>Normal Range (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-N-A</td>
<td>76.4 ± 6.10</td>
<td>77.5–81.5</td>
</tr>
<tr>
<td>S-N-B</td>
<td>76 ± 4.66</td>
<td>80–84</td>
</tr>
<tr>
<td>A-N-B</td>
<td>0.4 ± 1</td>
<td>1–4</td>
</tr>
</tbody>
</table>


### TABLE III
Comparison of Mean S-N-A Values and 95% Confidence Intervals of the International Centers*<br/>

<table>
<thead>
<tr>
<th>Center</th>
<th>Mean S-N-A (degrees)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (n = 23)</td>
<td>77.36</td>
<td>75.68–79.04</td>
</tr>
<tr>
<td>B (n = 26)</td>
<td>77.45</td>
<td>75.78–79.12</td>
</tr>
<tr>
<td>C (n = 23)</td>
<td>77.30</td>
<td>75.48–79.12</td>
</tr>
<tr>
<td>D (n = 26)</td>
<td>75.93</td>
<td>74.18–77.68</td>
</tr>
<tr>
<td>E (n = 30)</td>
<td>77.07</td>
<td>75.81–78.33</td>
</tr>
<tr>
<td>F (n = 23)</td>
<td>76.40</td>
<td>74.96–77.84</td>
</tr>
<tr>
<td>Odstock (n = 25)</td>
<td>76.40</td>
<td>74.01–78.79</td>
</tr>
</tbody>
</table>

* S-N-A, sella-nasion-subspinale angle; CI, confidence interval.

### TABLE V
Comparison of Mean A-N-B Values of Odstock Center with Eurocleft Centers and U.K. CSAG*<br/>

<table>
<thead>
<tr>
<th>Center</th>
<th>Mean A-N-B (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSAG</td>
<td>−0.4</td>
</tr>
<tr>
<td>Odstock</td>
<td>+0.4</td>
</tr>
<tr>
<td>Euro 1</td>
<td>+2.3</td>
</tr>
<tr>
<td>Euro 2</td>
<td>+1.8</td>
</tr>
<tr>
<td>Euro 3</td>
<td>+0.9</td>
</tr>
</tbody>
</table>


Veau flap remains the most popular technique for hard palatal repair (22.7 percent of palatal repairs)¹⁰; likewise, in the United States it remains a popular form of palatal repair.

The results of this current study demonstrate that Veau flap repairs can be associated with an acceptable growth outcome. Not only the surgical volume and organization of the center, but also the experience and surgical skills of the operator, may influence the long-term facial growth of these patients. The technique itself may not be the most critical factor. Indeed, analyses of the various studies shows that different cleft centers obtain variable results.

### TABLE VI
Comparison of Skeletal Pattern Results of Odstock Center with U.K. Average Values<br/>

<table>
<thead>
<tr>
<th>Skeletal Pattern</th>
<th>U.K. Population (%)</th>
<th>CSAG (%)</th>
<th>Odstock (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>41</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>II</td>
<td>54</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>70</td>
<td>68</td>
</tr>
</tbody>
</table>

* CSAG, Clinical Standards Advisory Group.
even when they use similar techniques. Unfortunately, skill, being a very subjective parameter, will probably always elude quantification.

Our study is significant in that it consists of a pure sample of cleft patients, as described earlier. This is in sharp contrast to most of the other published studies, in which the series may not be consecutive or there may be a mixture of surgeons and techniques. Our study contributes by excluding these compounding factors.

CONCLUSIONS

Our GOSLON score results are the second best in the United Kingdom, based on the Clinical Standards Advisory Group report, and are midway between the best and the worst results from the six Eurocleft centers. No significant differences were found in the cephalometric outcomes, based on the maxillary projection. The cleft service in our center has undergone major organizational changes since the study period, hence, further improvement can be expected in the outcomes.

As previously mentioned, all patients in the study underwent cleft palate repair using the Veau-Wardill-Kilner technique with muscle push-back. Based on our results, we conclude that satisfactory long-term midfacial growth can be obtained with the Veau-Wardill-Kilner cleft palate repair. We also believe that the skill and the experience of the cleft surgeon may be more important than a particular technique.

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REFERENCES