

## BACKGROUND

Individuals with cleft palate undergo repair of the palate via primary palatoplasty early in childhood. Velopharyngeal insufficiency (VPI) describes any degree of improper seal between the palate and the pharyngeal walls, an area called the velopharynx. Measurements of postoperative VPI can be used to determine the efficacy of a palatoplasty operation. Air entry into the nasopharynx during speech results in VPI, which manifests as hypernasality and audible nasal air emission.

## PURPOSE

The aim of this study was to longitudinally compare VPI outcomes in post-palatoplasty patients who underwent two different surgical techniques: Furlow repair versus straight line repair with intravelar veloplasty (IVVP).

## METHODS

- Retrospective chart review was performed for patients undergoing a primary palatoplasty via either the Furlow or straight line with IVVP technique from April 2012-May 2019
- Data points collected included gender, syndromic status, primary language, payer status, type of cleft, age at time of surgery, age at speech assessment, length of time between surgery and speech assessment, degree of hypernasality, presence of audible nasal air emission, and overall adequacy of velopharyngeal function. Pearson's Chi-squared test and multivariable t tests were used to analyze variables
- Logistic regression was used to control statistically significant variables between study cohorts

Figure 1: Veau Cleft Type Classification System

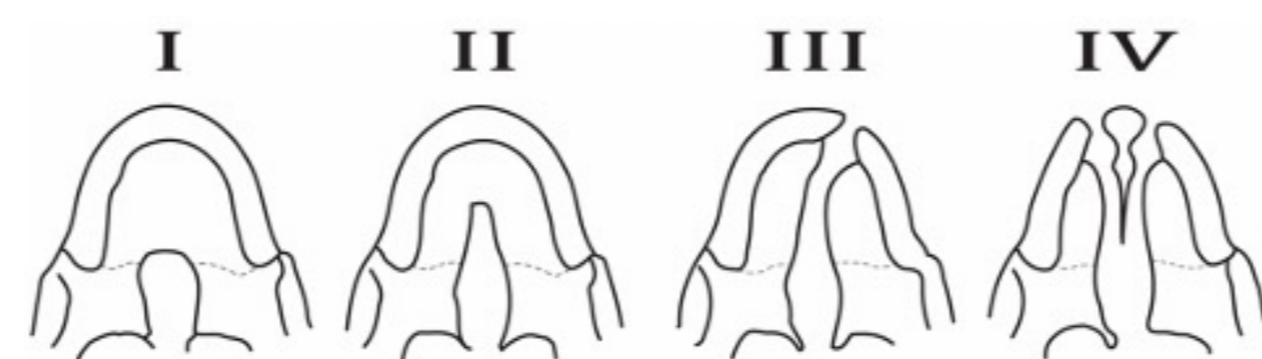


Table 1. Association between Speech Outcomes and Palatoplasty Technique

	All patients (n=181)	Furlow (n=61)	Straight line with IVVP (n=120)	Odds ratio	p-value
<b>Hypernasality</b>	(n=156)	(n=52)	(n=104)		
Absent or Borderline	113 (72.4%)	44 (84.6%)	69 (66.4%)		
Mild, Moderate, or Severe	43 (27.6%)	8 (15.4%)	35 (33.6%)	0.358	<i>p=0.046</i>
<b>Audible Nasal Air Emission</b>	(n=154)	(n=53)	(n=101)		
Absent	96 (62.3%)	39 (73.6%)	57 (56.4%)		
Present	58 (37.7%)	14 (26.4%)	44 (43.6%)	0.465	<i>p=0.279</i>
<b>Velopharyngeal function</b>	(n=155)	(n=53)	(n=102)		
Adequate	120 (77.4%)	47 (88.7%)	73 (71.6%)		
Inadequate	35 (22.6%)	6 (11.3%)	29 (28.4%)	0.321	<i>p=0.057</i>

Table 2: Pre-existing Patient Characteristics Compared to Hypernasality

	All patients (n = 156)	Absent/Borderline (n = 113)	Mild/Moderate/Severe (n = 43)	p-value
<b>Gender</b>				
Male	77 (49.4%)	59 (52.2%)	18 (41.9%)	
Female	79 (50.6%)	54 (47.8%)	25 (58.1%)	<i>p=0.248</i>
<b>Syndromic Status</b>				
Syndromic	28 (18.0%)	19 (16.8%)	9 (20.9%)	
Non-syndromic	128 (82.0%)	94 (83.2%)	34 (79.1%)	<i>p=0.549</i>
<b>Language</b>				
English	124 (79.5%)	91 (80.5%)	33 (76.7%)	
Other	32 (20.5%)	22 (19.5%)	10 (23.3%)	<i>p=0.601</i>
<b>Payer Status</b>				
Public Insurance	81 (51.9%)	61 (54.0%)	20 (46.5%)	
Private Insurance	75 (48.1%)	52 (46.0%)	23 (53.5%)	<i>p=0.404</i>
<b>Veau cleft type</b>				
V1 and V2	76 (48.7%)	56 (49.6%)	20 (46.5%)	
V3 and V4	80 (51.3%)	57 (50.4%)	23 (53.5%)	<i>p=0.734</i>
<b>Length of Speech Assessment</b>				
Formal	89 (57.0%)	57 (50.4%)	32 (74.4%)	
Brief	67 (43.0%)	56 (49.6%)	11 (25.6%)	<i>p=0.007</i> <i>*p=0.006</i>
<b>Moderate and/or Bilateral Hearing Loss</b>				
No	113 (72.4%)	86 (76.1%)	27 (62.8%)	
Yes	43 (27.6%)	27 (23.9%)	16 (37.2%)	<i>p=0.096</i>
<b>Mean age at surgery, years (SD)</b>	1.1 (0.2)	1.1 (0.3)	1.1 (0.2)	<i>p=0.715</i>
<b>Mean age at speech assessment, years (SD)</b>	4.6 (2.2)	4.6 (2.3)	4.7 (1.8)	<i>p=0.778</i>
<b>Mean length of time between surgery and speech assessment, years (SD)</b>	3.5 (2.1)	3.4 (2.3)	3.5 (1.8)	<i>p=0.808</i>

Table 3: Pre-existing Patient Characteristics Compared to Audible Nasal Air Emission

	All patients (n = 154)	Absent (n = 96)	Sometimes/Frequent (n = 58)	p-value
<b>Gender</b>				
Male	78 (50.7%)	50 (52.1%)	28 (48.3%)	
Female	76 (49.3%)	46 (47.9%)	30 (51.7%)	<i>p=0.647</i>
<b>Syndromic Status</b>				
Syndromic	27 (17.5%)	14 (14.6%)	13 (22.4%)	
Non-syndromic	127 (82.5%)	82 (85.4%)	45 (77.6%)	<i>p=0.216</i>
<b>Language</b>				
English	122 (79.2%)	81 (84.4%)	41 (70.7%)	
Other	32 (20.8%)	15 (15.6%)	17 (29.3%)	<i>p=0.043</i> <i>*p=0.192</i>
<b>Payer Status</b>				
Public Insurance	81 (52.6%)	53 (55.2%)	28 (48.3%)	
Private Insurance	73 (47.4%)	43 (44.8%)	30 (51.7%)	<i>p=0.404</i>
<b>Veau cleft type</b>				
V1 and V2	74 (48.0%)	48 (50.0%)	26 (44.8%)	
V3 and V4	80 (52.0%)	48 (50.0%)	32 (55.2%)	<i>p=0.534</i>
<b>Length of Speech Assessment</b>				
Formal	88 (57.1%)	48 (50.0%)	40 (69.0%)	
Brief	66 (42.9%)	48 (50.0%)	18 (31.0%)	<i>p=0.021</i> <i>*p=0.001</i>
<b>Moderate and/or Bilateral Hearing Loss</b>				
No	113 (73.4%)	77 (76.1%)	36 (62.8%)	
Yes	41 (26.6%)	19 (23.9%)	22 (37.2%)	<i>p=0.014</i> <i>*p=0.084</i>
<b>Mean age at surgery, years (SD)</b>	1.1 (0.2)	1.1 (0.2)	1.1 (0.2)	<i>p=0.627</i>
<b>Mean age at speech assessment, years (SD)</b>	4.6 (2.2)	4.4 (2.3)	5.1 (1.8)	<i>p=0.050</i> <i>*p=0.003</i>
<b>Mean length of time between surgery and speech assessment, years (SD)</b>	3.5 (2.1)	3.2 (2.3)	3.9 (1.9)	<i>p=0.056</i>

Table 4: Pre-existing Patient Characteristics Compared to Velopharyngeal Function

	All patients (n = 155)	Adequate (n = 120)	Inadequate (n = 35)	p-value
<b>Gender</b>				
Male	77 (49.7%)	62 (51.7%)	15 (42.9%)	
Female	78 (50.3%)	58 (48.3%)	20 (57.1%)	<i>p=0.359</i>
<b>Syndromic Status</b>				
Syndromic	30 (19.3%)	22 (18.3%)	8 (22.9%)	
Non-syndromic	125 (80.7%)	98 (81.7%)	27 (77.1%)	<i>p=0.551</i>
<b>Language</b>				
English	122 (78.7%)	96 (80.0%)	26 (74.3%)	
Other	33 (21.3%)	24 (20.0%)	9 (25.7%)	<i>p=0.467</i>
<b>Payer Status</b>				
Public Insurance	82 (52.9%)	64 (53.3%)	18 (51.4%)	
Private Insurance	73 (47.1%)	56 (46.7%)	17 (48.6%)	<i>p=0.843</i>
<b>Veau cleft type</b>				
V1 and V2	72 (46.5%)	56 (46.7%)	16 (45.7%)	
V3 and V4	83 (53.6%)	64 (53.3%)	19 (54.3%)	<i>p=0.921</i>
<b>Length of Speech Assessment</b>				
Formal	86 (55.5%)	63 (52.5%)	23 (65.7%)	
Brief	69 (44.5%)	57 (47.5%)	12 (34.3%)	<i>p=0.166</i> <i>*p=0.045</i>
<b>Moderate and/or Bilateral Hearing Loss</b>				
Not Present	111 (71.6%)	89 (74.2%)	22 (62.9%)	
Present	44 (28.4%)	31 (25.8%)	13 (37.1%)	<i>p=0.192</i>
<b>Mean age at surgery, years (SD)</b>	1.1 (0.3)	1.1 (0.3)	1.1 (0.2)	<i>p=0.995</i>
<b>Mean age at speech assessment, years (SD)</b>	4.7 (2.1)	4.5 (2.2)	5.2 (2.2)	<i>p=0.094</i> <i>*p=0.022</i>
<b>Mean length of time between surgery and speech assessment, years (SD)</b>	3.5 (2.1)	3.4 (2.1)	4.1(2.0)	<i>p=0.092</i>

## RESULTS

- Of the 181 patients included, 61 received a Furlow procedure and 120 received a straight line with IVVP procedure.
- Comparison of baseline characteristics between the two groups revealed a significant difference only in Veau cleft type (*p=0.046*).
- Controlling for Veau cleft type, clinically significant hypernasality was present in 33.6% of straight line with IVVP patients and 15.4% of Furlow patients (*p=0.046*, **Table 2**).
- Clinically significant audible nasal air emission was present in 43.6% of straight line with IVVP patients and 26.4% of Furlow patients (*p=0.279*, **Table 2**).
- Velopharyngeal function was classified as adequate in 71.6% of straight line with IVVP patients and 84.6% of Furlow patients (*p=0.016*).
- There was no significant relationship between the VPI outcomes and gender, syndromic status, language, payer status, Veau cleft type, hearing loss, or time between surgery and speech assessment (**Tables 3-5**).

## CONCLUSION

This single institution study suggests that the Furlow technique produces better speech outcomes than the straight line with IVVP palatoplasty procedure in terms of hypernasality, though their outcomes are comparable in terms of audible nasal air emission and overall velopharyngeal function. VPI outcomes may be more closely associated with factors pertaining to the speech assessment itself.

## REFERENCES

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