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ORIGINAL RESEARCH

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Correlation of the Chinese velopharyngeal insufficiency-related quality of life instrument and speech in subjects with cleft palate

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Abstract

Objective: Assessment of the hypothesized correlation between the Chinese Velopharyngeal Insufficiency (VPI) Effects on Life Outcomes (VELO) instrument and measured speech parameters.

Methods: A cross-sectional study was conducted in the Oral Clefts Center of West China Hospital of Stomatology between January 2019 and December 2019. Speech parameters including speech intelligibility deficit, VPI severity, VP gap, and need for speech therapy were evaluated by speech-language pathologists. All patients and their parents completed the VELO instrument. The correlation between aforementioned speech parameters and VELO scores was examined utilizing Spearman correlation coefficients. The reliability of VELO test–retest and parent proxy assessment was estimated utilizing intraclass correlation coefficients (ICC). A receiver operating characteristic curve was used to calculate the cutoff VELO score.

Results: One hundred and forty patients with their parents were enrolled. The mean age was 12.58 ± 3.72 years. Both parent and youth VELO total and domain scores recorded moderate to strong correlations with all speech parameters ($r > -.40$, $P < .001$) except the swallowing domain. Most VELO domain items have shown significant correlations with at least one speech parameter. Moreover, the scales of all speech parameters showed different VELO scores ($P < .001$). The ICC reported test–retest correlation >.73 in all domains, and parent proxy correlation >.63 in most domains except the emotional and perception domains. The cutoff VELO score was 79.04 in parent version and 85.77 in youth version.

Conclusions: The correlations between VELO scores and measured speech parameters have provided evidence for test–retest and parent proxy reliability and criterion

and construct validity of the Chinese version of the VELO instrument. A VELO score ≥79.04 (in parent version) or ≥85.77 (in youth version) mostly reflects proper speech-related quality of life. Hence, this instrument could serve as a simple tool to help clinicians understand the social, emotional, and physical influences of VPI.

KEYWORDS
Chinese VELO, cleft palate, quality of life, validity, velopharyngeal insufficiency

1 | INTRODUCTION

Health-related quality of life (HRQOL) is a valuable measure to represent a patient's perception of his/her health status impact on functioning and well-being.[1,2] Velopharyngeal dysfunction (VPD) is a broad category of inadequacies described by inadequate closure between the velum and pharyngeal wall during function.[3] As a result, speech, swallowing, and various psychological aspects are affected in a way that children with VPD experience a lower quality of life (QOL) than the others with normal velopharyngeal function.[4] VPD is a multifactorial dysfunction that could be due to neuromuscular malfunction or structural deficiency or both.[3] Thereby, any child who has a cleft palate is often at risk of experiencing VPD, specifically velopharyngeal insufficiency (VPI) due to the structural defect of the palate. Although many children can get proper speech after surgical repair of the cleft palate, 20–30% of children with repaired cleft palate still sustain residual deficits (VPI).[5]

It is generally accepted that children present with orofacial clefts (OCs) tend to have more significant behavioral issues and many social and academic impairments, raised aspects of depression, and are more easily teased.[6] Many previous OCs studies decided their judgment for surgical outcomes, relying on non-patient-reported measures, for example, perceptual speech analysis, anatomic measures, photo evaluation, morbidity, and mortality.[7,8] However, patients' personal feelings should also be considered when deciding the need for corrective surgery and judging the surgical outcomes. Hence, QOL investigations have been given priority for future studies of OCs, and effective patient-reported instruments are critical.[9] However, few researchers have utilized reliable measures to examine whether offered treatments support better outcomes in children's QOL.

The administration of speech questionnaires has been considered to support a reasonable means of identifying speech-related QOL.[10,11] Among the available QOL instruments, the VPI Effects on Life Outcomes (VELO) instrument is a questionnaire established by Skirko et al. to report the VPI-related effects on QOL among patients with VPI. This instrument has been considered to correlate well with previous reliable speech-related QOL questionnaires, in addition to patient-reported and professional-assessed outcomes.[12,13] Subsequently, the original (English) VELO instrument has been translated and adapted into some other languages, including Mandarin.[14] Mandarin is the official language of around 1.4 billion people in the People's Republic of China.[14] Therefore, the Chinese version of the VELO instrument could have an enormous impact on the global care of patients with cleft palate and VPI.

The validity of a questionnaire is its fineness in testing what it was proposed to test, in our case, to test the impact of VPI on QOL. Although the Chinese version of the VELO instrument has shown adequate internal consistency, discriminative validity, and acceptable construct validity,[14] test–retest reliability, criterion validity, and parent proxy assessment reliability have not been reported yet. In particular, test–retest reliability determines the level to which multiple repetitions over a time period yield comparable outcomes. Criterion validity can be considered when achieving acceptable association with a gold standard measure. In the present case, perceptual speech assessment is the most frequently used.[15] Besides, construct validity can be established when hypothesized correlation between a questionnaire and related health conditions is positive.[13]

The present study aims to fulfill the following: (1) to test the association between the VELO scores and perceptual and instrumental speech parameters examined by the speech-language pathologists, (2) to further validate the Chinese version of the VELO instrument (test–retest and parent proxy reliability, and criterion and construct validity), and (3) to indicate the cutoff VELO score. Given that the VELO instrument captures speech-related QOL, a negative correlation between the VELO scores and speech parameters was then hypothesized and regarded as evidence to further support the validity of the Chinese VELO instrument.

2 | MATERIALS AND METHODS

2.1 | Study design and participants

After receiving the Institutional Review Board approval of West China Hospital of Stomatology, Sichuan University (No. WCHSIRB-D-2016-084R1), a cross-sectional descriptive study was conducted on subjects with repaired cleft palate between January 2019 and December 2019. Subjects were enrolled in the current study when they met the following criteria: a history of cleft palate, older than 8 years, with/without corrective speech surgery at the time of enrollment, and have Chinese language as their mother language. The selection of subjects also included a range of severity in terms of speech intelligibility, velopharyngeal insufficiency, and velopharyngeal gap, established based on the speech evaluation performed at the time of enrollment into the study. On the other hand, subjects who showed severe intellectual disability and those who underwent VPI surgery within 6 months prior to enrollment were excluded.

The sample size was determined by using NCSS and PASS statistical software (V. 2021. Kaysville, UT) based on a significance level of .01, a power of 90%, with a medium effect size that was calculated based on the difference of total VELO scores reported in a previous study.[13] Patients and their parents assented after being informed about the purpose of the study, and parents and/or patients older than 18 years signed consent forms after being given written information.

2.2 | Speech evaluation

Perceptual speech and velopharyngeal function assessments were conducted following standardized and validated parameters and scales.[16,17] The subjects were assessed by two speech-language pathologists (SLPs), and the procedure has been described in detail in previous studies.[18,19] Data of speech intelligibility, VPI severity, velopharyngeal gap, and need for speech therapy were collected at the same day of enrollment and utilized to represent speech parameters due to their moderate to high association with VPI-specific QOL as reported in previous studies.[13,20,21]

Speech intelligibility deficit was assessed through the whole spontaneous and conversational speech sample by estimating the hoarseness and volume of voice, speech tone, articulation, resonance, and air emission. A 4-point scale was used to record the speech intelligibility data: 0 = *no intelligibility deficit*, 1 = *mild intelligibility deficit*, 2 = *moderate intelligibility deficit*, or 3 = *severe intelligibility deficit*.

VPI severity was estimated based on resonance severity and nasal air emission as well as nasal endoscopy. A 4-point scale was also used to rate VPI: 0 = *no VPI*, 1 = *mild VPI*, 2 = *moderate VPI*, or 3 = *severe VPI*. The velopharyngeal gap was estimated depending on nasal endoscopy. A 4-point scale was used to rate gap size: 0 = *no gap*, 1 = *small gap*, 2 = *moderate gap*, or 3 = *large gap*.

The need for speech therapy was assessed depending on spontaneous speech, automatic sequences, and repetition of the words and sentences and rated using a dichotomous grade where 0 represents no need for speech therapy, and 1 represents a need for speech therapy. On the other hand, the subjects whether or not to undergo corrective surgery was estimated based on the most commonly used speech parameters (speech intelligibility and VP function). The scales 0 and 1 were regarded as adequate speech, and the corresponding subject did not need further corrective surgery.[19,22]

2.3 | VELO outcome collection

The VELO instrument involves two versions, the parent version with 26 items and the youth version with 23 items. The 26 items version was given to all parents, and the 23 items version was given to the patient if he/she was older than 8 years. The response format is a 5-point Likert-type scale ranging from never (0) to almost always (4), in which the total score ranges between 0 and 100, with 100 being the best possible health-related quality-of-life. In addition, there are five main domains included in the VELO, speech limitation, swallowing problems, situational difficulty, emotional impact, and perception by others. Furthermore, caregiver impact is an additional domain added to the parent version. All subjects enrolled in the current study (140 pairs of patients and parents) have completed a self-administered survey questionnaire (validated Chinese VELO instrument) under the guidance of trained investigators.

2.4 | Statistical analysis

IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY) was used to perform the required statistical analyses. Descriptive statistics were presented as mean and standard deviation, median and range, or frequency and percentage where appropriate. Regarding the speech and VELO measures reliability, 40% of participants were randomly selected and underwent a 1-month interval re-assessment of speech parameters and test–retest of the VELO instrument. The repeated perceptual speech evaluations were completed in-person with the same SLPs as the initial evaluation for the study. In context, the speech inter and intrarater agreements were identified utilizing quadratic weighted kappa[23] and interpreted following the format presented by Altman.[24] The VELO test–retest reliability and parent proxy estimation were calculated using the intraclass correlation coefficient (ICC) and Wilcoxon rank test, where a correlation greater than .60 was regarded as a substantial association.[25]

A receiver operating characteristic curve (ROC curve) and Youden's index were used to calculate the cutoff VELO score, which may help estimating subjects who need further corrective surgery. The cutoff VELO score was 79.04 in parent version and 85.77 in youth version (calculation process was shown in Data S1, Supporting Information). Thus, a VELO score <79.04 (in parent version) or <85.77 (in youth version) may indicate a patient whose QOL would benefit from further corrective surgery.

The correlations between the VELO scores and speech parameters were measured by Spearman's rank correlation coefficients. The power of the correlation coefficient was described following the classification presented by Mukaka,[26] with a correlation $r > .40$ was regarded substantial enough to support validity as this correlation is equivalent to a coefficient of determination of .16. Furthermore, the analysis of variance using the Kruskal–Wallis test or Mann–Whitney *U* test was performed to estimate the difference in the VELO total and domain scores among the scales of speech parameter. The consistency between the speech evaluation and VELO instrument regarding estimation the need for further corrective speech surgery was estimated by the Kappa test and the paired χ^2 test. The significance level was set at .01.

3 | RESULTS

3.1 | Participant characteristics

A total of 140 patients were enrolled with a mean age of 12.58 years, ranging from 8.2 to 23 years. Among the cases, 62.9%

were males, 60% had speech intelligibility deficiency, 61.4% showed velopharyngeal insufficiency, 72.9% presented with a velopharyngeal gap. The descriptive data of subject characteristics in VPC and VPI groups were given in Table 1. Patients reported slightly higher (better quality of life) VELO scores than their parents (mean total score, 81.27 and 75.28, respectively). The distribution of total VELO scores in VPC and VPI groups was illustrated using the box plot (Figure 1).

3.2 | Reliability

All speech parameters have showed very good inter and intrarater agreements with Kappa ranging from .85 to .95. The Chinese version of the VELO instrument has reported a good test–retest reliability in both parent and youth total and domain scores, with an ICC ranging from .73 to .89 and nonsignificant *P*-values. Besides, the parent proxy was reliable, with nonsignificant *P*-values and an ICC greater than .6 for the total score and most domains except the emotional and perception domains (Table 2).

3.3 | Correlation between speech parameters and VELO scores

All speech parameters have recorded statistically significant negative correlations with both parent and youth total VELO score ($P < .001$): speech intelligibility, $r = -.73, -.68$; VPI severity, $r = -.73, -.66$; VP gap, $r = -.52, -.46$; and need for speech therapy, $r = -.61, -.52$, respectively (Tables 3 and 4). There were significant negative correlations between all speech parameters and VELO domain scores ($P < .001$) except the swallowing domain, which recorded correlations less than .40. The speech intelligibility and VPI severity have recorded slightly higher correlations compared with the other parameters.

Moreover, the post hoc correlations between the speech parameters and scores of VELO domain items, highlighting the most significant correlation of each item, were shown in Table 5. All speech parameters have recorded their highest associations with the following parent domain items (the most significant correlation of the item with the speech parameter): speech domain item no. 5 ($r = -.62$, with speech intelligibility and VPI severity);

TABLE 1 Characteristics of the enrolled participants (140 patients)

Parameter	VPC, no. (%)	VPI, no. (%)	Total, no. (%)
Age (year)			
Mean (SD)	11.91 (3.51)	13 (3.81)	12.58 (3.72)
Median (range)	11 (8.20–23)	12.87 (8.20–23)	12 (8.20–23)
Gender			
Male	36 (25.71)	52 (37.14)	88 (62.85)
Female	18 (12.86)	34 (24.29)	52 (37.14)
Speech intelligibility deficiency			
None	54 (38.57)	2 (1.43)	56 (40)
Mild	0	22 (15.7)	22 (15.7)
Moderate	0	30 (21.4)	30 (21.4)
Severe	0	32 (22.9)	32 (22.9)
VPI severity			
None	54 (38.6)	0	54 (38.6)
Mild	0	24 (17.1)	24 (17.1)
Moderate	0	26 (18.6)	26 (18.6)
Severe	0	36 (25.7)	36 (25.7)
Velopharyngeal gap			
None	38 (27.1)	0	38 (27.1)
Small	16 (11.4)	29 (20.7)	45 (32.1)
Moderate	0	33 (23.6)	33 (23.6)
Large	0	24 (17.1)	24 (17.1)
Need speech therapy	0	86 (61.4)	86 (61.4)
Total VELO score			
Parent VELO, mean (SD)	91.65 (8.08)	65.80 (20.66)	75.28 (21.43)
Parent VELO, median (range)	92.31 (66.35–100)	67.79 (9.62–98)	83.65 (9.62–100)
Youth VELO, mean (SD)	91.87 (7.30)	75.24 (15.60)	81.27 (15.66)
Youth VELO, median (range)	92.39 (69.57–100)	78.26 (27.2–98)	84.78 (27.2–100)

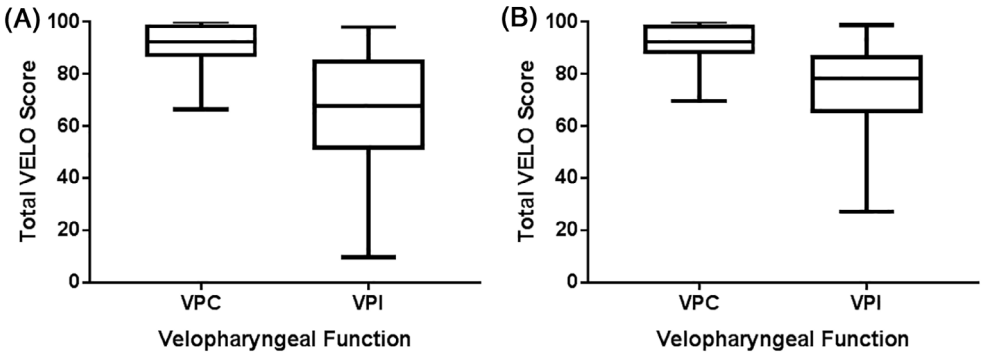

FIGURE 1 Box plots illustrate spread of the total VELO scores (A, parent; B, youth) of VPC and VPI groups

TABLE 2 Test–retest and parent proxy reliability of the VELO

	Test–retest reliability				Parent proxy reliability	
	Parent		Youth		Parent and youth	
VELO scores	ICC (95% CI)	*P**	ICC (95% CI)	*P**	ICC (95% CI)	*P**
Total score	0.87 (0.82–0.90)	.691	0.83 (0.77–0.87)	.821	0.68 (0.55–0.78)	.290
Domain score						
Speech limitations	0.89 (0.85–0.92)	.550	0.78 (0.71–0.84)	.438	0.72 (0.61–0.80)	.476
Swallowing problems	0.83 (0.76–0.88)	.456	0.87 (0.82–0.90)	.407	0.64 (0.49–0.74)	.143
Situational difficulty	0.82 (0.76–0.87)	.353	0.77 (0.69–0.84)	.474	0.63 (0.48–0.73)	.222
Emotional impact	0.76 (0.68–0.82)	.290	0.73 (0.64–0.79)	.304	0.53 (0.34–0.66)	.037
Perception by others	0.73 (0.64–0.79)	.246	0.75 (0.66–0.81)	.313	0.48 (0.27–0.63)	.034
Caregiver impact	0.78 (0.71–0.84)	.333	NA	NA	NA	NA

Note: *P*-value using the Wilcoxon rank test.
Abbreviation: NA, not applicable.

TABLE 3 Spearman correlations between speech parameters and parent VELO total and domain scores

	Speech parameter							
	Speech intelligibility		VPI severity		VP gap		Need speech therapy	
Parent VELO scores	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Total score	*−.73*	<.001**	*−.73*	<.001**	*−.52*	<.001**	*−.61*	<.001**
Domain score								
Speech limitations	*−.72*	<.001**	*−.71*	<.001**	*−.46*	<.001**	*−.58*	<.001**
Swallowing problems	−.21	.013*	−.17	.037*	−.07	.368	−.24	.003**
Situational difficulty	*−.68*	<.001**	*−.72*	<.001**	*−.53*	<.001**	*−.58*	<.001**
Emotional impact	*−.64*	<.001**	*−.64*	<.001**	*−.46*	<.001**	*−.49*	<.001**
Perception by others	*−.62*	<.001**	*−.62*	<.001**	*−.48*	<.001**	*−.47*	<.001**
Caregiver impact	*−.63*	<.001**	*−.65*	<.001**	*−.47*	<.001**	*−.52*	<.001**

*Trend correlation at .01 < *P* < .05.
**Significant correlation at *P* ≤ .01. Correlation greater than .40 appeared in italic.

swallowing domain item no. 10 ($r = -.36$, with speech intelligibility); situational domain item no. 14 ($r = -.70$, with VPI severity); emotional domain item no. 17 ($r = -.60$, with both speech intelligibility and VPI severity), while the VP gap parameter was highly correlated with the emotional item no. 18 ($r = -.58$, with speech intelligibility); perception domain item no. 23 ($r = -.60$, with VPI severity); and caregiver domain item no. 24 ($r = -.56$, with VPI severity). Meanwhile, the speech parameters have recorded the highest associations with the following youth domain items: speech domain item no. 5 ($r = -.54$, with speech intelligibility); swallowing domain item no. 9 ($r = -.22$, with speech intelligibility); situational domain item no. 11 ($r = -.58$, with speech intelligibility); emotional domain

TABLE 4 Spearman correlations between speech parameters and youth VELO total and domain scores

	Speech parameter							
	Speech intelligibility		VPI severity		VP gap		Need speech therapy	
Youth VELO scores	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Total score	*−.68*	<.001*	*−.66*	<.001*	*−.46*	<.001*	*−.52*	<.001*
Domain score								
Speech limitations	*−.64*	<.001	*−.62*	<.001*	*−.43*	<.001*	*−.49*	<.001*
Swallowing problems	−.12	.159	−.11	.185	−.03	.675	−.14	.113
Situational difficulty	*−.62*	<.001*	*−.60*	<.001*	*−.42*	<.001*	*−.45*	<.001*
Emotional impact	*−.51*	<.001*	*−.51*	<.001*	*−.41*	<.001*	*−.41*	<.001*
Perception by others	*−.57*	<.001*	*−.56*	<.001*	−.35	<.001*	*−.45*	<.001*

*Significant correlation at $P \leq .01$. Correlation greater than .40 appeared in italic.

TABLE 5 Post hoc Spearman correlations between speech parameters and VELO domain items

	Parent VELO				Youth VELO			
	Speech parameter				Speech parameter			
VELO domain item	Speech intelligibility	VPI severity	VP gap	Need speech therapy	Speech intelligibility	VPI severity	VP gap	Need speech therapy
Speech limitation								
1. Air comes out my nose when I talk	*−.48***	−.45**	−.22**	−.37**	*−.40***	*−.40***	−.23**	−.32**
2. I run out of breath when I talk	*−.45***	−.43**	−.26**	−.34**	*−.40***	−.35**	−.30**	−.31**
3. It is hard talking in long sentences	*−.53***	−.52**	−.30**	−.42**	*−.43***	−.41**	−.23**	−.38**
4. My speech is too weak	−.41**	*−.43***	−.27**	−.41**	*−.29***	−.28**	−.20*	−.26**
5. I have trouble being understood when I'm in a hurry	*−.62***	*−.62***	−.46**	−.53**	*−.54***	−.53**	−.40**	−.44**
6. My speech gets worse toward the end of the day	*−.36***	−.34**	−.20*	−.32**	*−.28***	−.26**	−.12	−.24**
7. My speech sounds different than other kids	*−.52***	*−.52***	−.33**	−.43**	−.40**	*−.42***	−.24**	−.33**
Swallowing problems								
8. Liquids come out my nose while drinking	−.09	−.07	.04	*−.16*	−.05	−.06	.01	*−.08*
9. Food comes out my nose while eating	*−.12*	−.11	.02	*−.12*	*−.22***	−.20*	−.15	−.21*
10. Others make fun of me when food or liquids come out my nose	*−.36***	−.34**	−.32**	−.30**	*−.15*	−.12	−.03	−.10
Situational difficulty								
11. My speech is hard for strangers to understand	−.62**	*−.64***	−.47**	−.54**	*−.58***	−.57**	−.45**	−.45**
12. My speech is hard for friends to understand	−.57**	*−.60***	−.43**	−.49**	*−.47***	−.46**	−.31**	−.33**
13. My speech is hard for family to understand	−.50**	*−.53***	−.35**	−.44**	*−.43***	−.42**	−.31**	−.30**
14. I have trouble being understood when others cannot see my face, for example, in a car	−.67**	−.70**	−.52**	−.57**	*−.43***	−.40**	−.23**	−.36**
15. I have trouble being understood on the phone	−.62**	*−.64***	−.49**	−.54**	*−.42***	−.41**	−.24**	−.34**
Emotional impact								

(Continues)

TABLE 5 (Continued)

VELO domain item	Parent VELO				Youth VELO			
	Speech parameter				Speech parameter			
	Speech intelligibility	VPI severity	VP gap	Need speech therapy	Speech intelligibility	VPI severity	VP gap	Need speech therapy
16. I am teased because of how I talk	−.56**	−.56**	−.41**	−.44**	−.42**	−.43**	−.37**	−.36**
17. I get sad because of how I talk	−.60**	−.60**	−.40**	−.48**	−.47**	−.45**	−.34**	−.35**
18. I get frustrated or give up when I am not understood	−.58**	−.57**	−.43**	−.47**	−.35**	−.34**	−.23**	−.23**
19. I am shy because of how I talk	−.54**	−.53**	−.37**	−.43**	−.40**	−.42**	−.42**	−.32**
Perception by others								
20. I am treated like I am not smart because of how I talk	−.49**	−.48**	−.39**	−.41**	−.30**	−.27**	−.13	−.23**
21. Others ignore me because of how I talk	−.56**	−.53**	−.43**	−.43**	−.31**	−.28**	−.15	−.24**
22. Others do not like to talk on the phone with me because of how I talk	−.49**	−.49**	−.37**	−.40**	−.30**	−.30**	−.19*	−.19*
23. My family or friends tend to talk for me	−.57**	−.60**	−.44**	−.47**	−.52**	−.52**	−.38**	−.41**
Caregiver impact								
24. I am worried or concerned about my child's speech	−.54**	−.56**	−.41**	−.41**	NA	NA	NA	NA
25. I find it difficult to understand my child	−.49**	−.52**	−.35**	−.41**	NA	NA	NA	NA
26. My child's speech problem slows me down or inconveniences me	−.47**	−.45**	−.32**	−.37**	NA	NA	NA	NA

Note: The most significant correlation of each item highlighted in italic.
Abbreviation: NA, not applicable.
*Trend correlation at .01 < *P* < .05.
**Significant correlation at *P* ≤ .01.

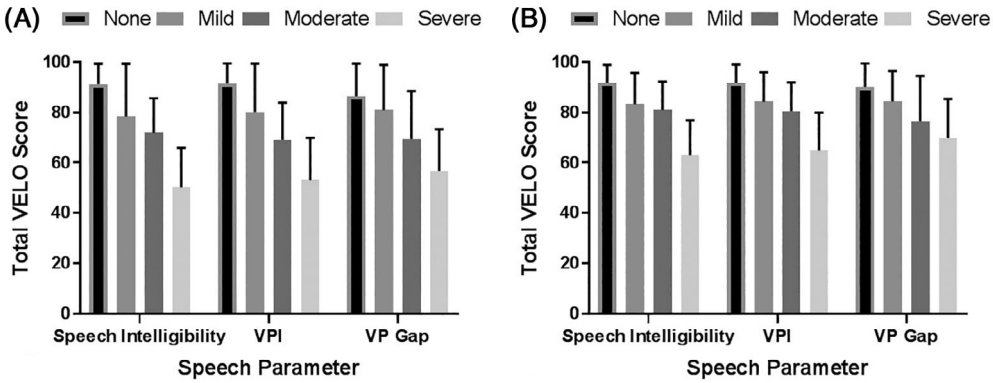

FIGURE 2 Comparison of mean total VELO scores (A, parent; B, youth) among the scales of speech parameter

items no. 17 (speech intelligibility and VPI severity), no. 19 (VP gap), and no. 16 (need for speech therapy), and the highest correlations for the items no. 16, 17, and 19 were found with VPI severity ($r = -.43$), speech intelligibility ($r = -.47$), and both speech intelligibility and VPI severity ($r = -.42$), respectively; and perception domain item no. 23 ($r = -.52$, with both speech intelligibility and VPI severity).

3.4 | Comparison of VELO scores among the scales of speech parameter

In both parent and youth VELO, the total and almost all domain scores (except the swallowing domain) showed significant differences ($P < .001$) among the various severity scales (normal, mild, moderate, and severe) of each speech parameter (Figure 2 and Table S1).

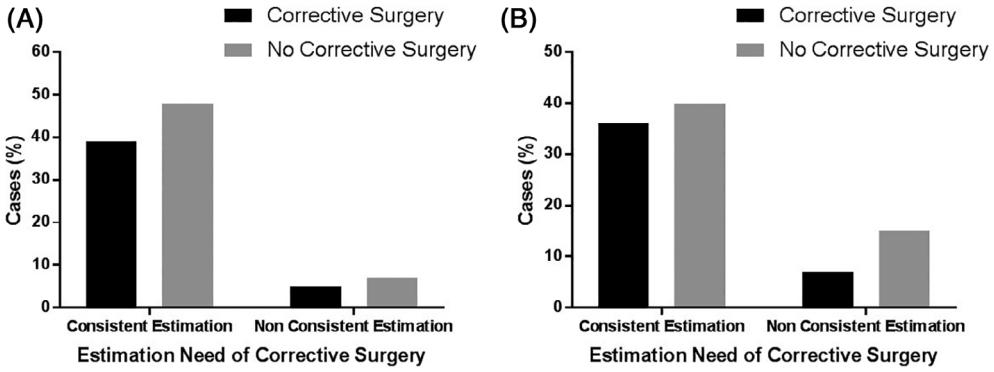

FIGURE 3 Consistency of estimating the need for corrective surgery between the speech evaluation and VELO instrument (A, parent; B, youth)

3.5 | Consistency of estimating the need for further corrective surgery

The results of estimating the need for further corrective surgery using speech evaluation and VELO instrument were given in Figure 3 and Table S2. The parent VELO instrument revealed a need of corrective surgery in 46.4% of cases, 39.2% of them had consistent estimation by the speech evaluation. In addition, the youth VELO instrument revealed a need of corrective surgery in 51.4% of cases; among them, 36.4% had consistent estimation by the speech evaluation. On the other hand, the Kappa test showed good agreements for estimating the need of corrective surgery by the speech evaluation and parent and youth VELO ($\kappa = .7$ and .6, respectively). Moreover, there was no significant difference in the estimating outcomes between the speech evaluation and parent and youth VELO ($P = .664$ and .110, respectively).

4 | DISCUSSION

The reliability and validity of a newly applied questionnaire are essential and recommended aspects to be established. Recently, the Chinese version of the VELO instrument has been developed and adapted from the original English version.[14] It has shown excellent internal consistency, discriminant validity, and adequate construct validity. The current cohort was sought to test the correlation between speech parameters and scores of the VELO instrument. In the context, most speech parameters showed an inversely proportional association with the VELO scores, and such correlation is consistent with the previously stated hypothesis. Thereby, the current cohort further supports the validation and reliability of the Chinese VELO instrument, which then can be utilized for patients with OCs and VPI.

Further evidence of criterion and construct validity of the Chinese VELO has been provided based on our findings. Significant correlations between all speech parameters (speech intelligibility, VPI severity, VP gap, and need for speech therapy) assessed by speech-language pathologists and both parent and youth VELO total and domain scores have been considered. Although the swallowing domain and items reflected a slight negligible correlation, they did not reach the correlation threshold (.40). This finding was in line with the previous studies, in which the swallowing domain has recorded the least correlation compared with the other VELO domains.[13,20,21] This may be illustrated as the swallowing domain contained only three items, which make it easily affected by subject responses. However, most other domain items reshowed significant associations with all speech parameters, particularly speech intelligibility and VPI severity. Similar findings regarding the correlation of VELO scores to speech intelligibility were reported in previous studies.[13,20] Nevertheless, contrary to our findings, no association with VPI severity was considered, which may be owing to the limited sample size in their cohorts. Moreover, no previous studies have examined the correlation between the previously mentioned speech parameters and the items of each domain, like we did in our study (Table 5). Such correlations could be explained as the perceptual speech assessment, including some specific measures (resonance, nasal air emission, and speech understandability and acceptability), is widely accepted as the gold standard for most speech parameters evaluation. Hence, these specific speech measures commonly affect the general speech parameters like speech intelligibility and others.

More specifically, the Chinese VELO instrument showed high sensitivity or responsiveness to capture the different degrees of VPI-related speech deficit. Meanwhile, the variance analysis has shown that the various scales of speech deficit (normal, mild, moderate, and severe) have reported different VELO total and domain scores ($P < .001$). In the context, the higher the scale of speech deficit, the lower the VELO score.

The internal consistency of the Chinese VELO instrument was excellent as reported in the previous study.[14] In addition, the test–retest reliability has been ensured in the current study based on the substantial ICC values (.73–.89) and the nonsignificant difference revealed by the Wilcoxon rank test. Thereby the domain and item scores in the Chinese VELO instrument are now adequately stable to assess changes in QOL. Subsequently, future longitudinal studies involving repeated assessments can be precisely proceeded.

There was slight variation in VELO scores between parent and youth responses, particularly the emotional and perception domains score, which might mirror various emotional responses by patients and parents if the patients are presented with some difficulties. Similar findings have been reported in previous studies,[14,27] which may indicate a greater parental perception of the negative effect on

HRQOL of their children. The interrater reliability revealed an ICC value greater than .6 for most domains, which then supported the validity of the parent proxy assessment of the Chinese VELO instrument. Comparable results were reported in both the initial 48-item and 23/26-item VPI-related QOL instruments.[4,27]

Most VPI-related literature have recognized the perceptual speech and velopharyngeal function assessments as their main procedures to estimate the surgical outcomes and likewise to judge the need for further corrective surgery. Based on this manner, 44.2% of the present cases were diagnosed as having improper speech and had to undergo further corrective surgery. However, one of the innovative aspects of the current study was the identification of cutoff VELO score using ROC curve. The cutoff value was equal to 79.04 in parent VELO and 85.77 in youth VELO. Therefore, a VELO score ≥79.04 or ≥85.77 indicates a proper VPI-related QOL and then mostly no need for further corrective surgery. Whereas, a VELO score <79.04 or <85.77 indicates improper VPI-related QOL, which then may need further corrective surgery. Hence, based on the parent or youth cutoff VELO score, 46.4% or 51.4% of our cases, respectively, showed improper VPI-related QOL and then need further corrective surgery. Based on our results, both speech evaluation and VELO instrument have reported comparable findings in term of identifying the need for further corrective surgery. Subsequently, we suggest that both speech and VELO assessments to be used together to assess the patient's VPF and QOL status. Following this suggestion, an absolute 39.2% (with parent VELO) or 36.4% (with youth VELO) of the current cases showed inadequate velopharyngeal function and quality of life, which have to undergo further corrective surgery. Even though SLPs-reported speech evaluation is still the gold-standard measure, the VELO instrument could be used as a screening tool to determine which patients should be referred for more detailed assessment, particularly in a resource-limited setting.

Finally, this work would benefit cleft palate patients and help improve the level of patient-centered measure application in otolaryngologic and cleft palate care. Although the VELO instrument cannot replace SLPs-reported speech assessment, it could serve as a simple tool to understand patients' concern, particularly in a resource-limited setting. Future investigations should be conducted to examine this instrument further and are currently underway by our group. As the present study includes only a single institution, the outcomes may not be applicable outside of western China. Further studies should be done based on a multicenter collaboration to further support the validation of the Chinese version of the VELO instrument.

5 | CONCLUSION

Our findings have provided further evidence of test–retest and parent proxy assessment reliability and criterion and construct validity of the Chinese version of the VELO instrument. Combining speech assessment and VELO instrument can lead to proper therapy decisions, targeting speech aspects that significantly impact patient health-related QOL.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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SUPPORTING INFORMATION

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