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Common practices of craniofacial professionals after cleft palate and Velopharyngeal surgery: evaluation & reporting speech outcome perspective.

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Abstract:

Background: There is a high prevalence of cleft palate & Velopharyngeal surgeries and significant variation in the evaluation methods and reporting speech results after surgical intervention. Hence, current study was conducted to determine the common practices of craniofacial professionals in evaluating and reporting the speech outcomes after cleft palate and Velopharyngeal surgery.

Methods: This cross-sectional study using purposive sampling recruited a sample of N=96 professionals from Cleft Lip and Palate Association of Pakistan Hospital (CLAPP Hospital, and General Hospital Lahore from July to December, 2021. Basic Demographic sheet and a self-structured reliable tool was used for data collection with CVI 0.96 and Cronbach alpha value of 0.7 calculated through SPSS. Sample included Speech-Language Pathologists, Plastic surgeons and Otolaryngologists of both genders, having at least 1 year experience of working in the field. SPSS Version 21 was used for data analysis. Chi-square test was used to see associations. $P<0.05$ was considered significant.

Results: Ninety-six questionnaires were completed. The majority of respondents reported the pharyngeal flap as the most often performed VPI surgery. Most respondents reported evaluations to include: perceptual evaluation, intra-oral examination and nasopharyngoscopy. Reported criteria for surgical success included "improved" and "acceptable". Majority of the participants believed that surgical success should be determined by speech-language pathologist and also by the treating surgeon and the patient/family.

Conclusion: There is inconsistency in the definition of success & marked inconsistency in the way speech outcomes are being evaluated and reported necessitating reliable speech assessment protocol to evaluate the Velopharyngeal function. This will allow relevant and meaningful comparisons between procedures, surgeons, and the clinical centers which can contribute in determining which procedures actually result in the best speech outcomes for variety of patients with cleft palate and Velopharyngeal insufficiency.

Keywords:

Craniofacial professionals, Cleft palate, craniofacial clefts, Velopharyngeal insufficiency.

Introduction

Cleft lip and / or palate constituted the most prevalent congenital orofacial defect. Cleft lip (CL) with or without cleft palate (CP) occur in 1 out of 700 children, while CP is present in 1 out of 2000 children. Cleft lip & palate (CLP) are more commonly seen in boys while CP alone is more common in girls (1). CL is more commonly associated with cosmetic problems while CP results in serious functional problems including speech, resonance and hearing impairment (HI), so much so that some anatomical issues like Velopharyngeal insufficiency (VPI) being the most common anatomical defect may persist following successful surgical repairs & speech issues may persist after palatal surgery in 5-40% cases (2).

Velopharyngeal Insufficiency including Velopharyngeal gap and Velopharyngeal incompetence occurs when the soft palate doesn't articulate with the posterior pharyngeal wall leading to nasal air emission and nasal

resonance issues during speech production. Velopharyngeal incompetence is a physiological failure of Velopharyngeal structures usually resulting from neuromuscular disorders, hypotonia, paralysis or paresis of velum (1).

Literature reveals that even following primary surgical CP repair 5 to 20% cases get VPI (3), and 20 to 50% get it following primary bone graft surgery (4). Irrespective of the type of VPI, it results in a speech disorder that comprises of a mixture of hyper-nasality, nasal emissions, short length of utterances, weak consonants and abnormal articulatory patterns. Speech therapy is not effective in correcting nasality due to abnormal physiology. To correct VPI usually surgical or sometimes prosthetic management is required because it is a disorder that is caused by structural or physiological impairment (5).

Speech is a fundamental element of care for cleft palate patients that has a strong impact on their development & psychological well-being; communication competency and quality of life. A cleft palate repaired before phonemic development would minimize compensatory articulation errors and assist in normal speech production. With a number of surgical interventions for repairing cleft palate in vague, it is difficult to suggest which technique is the best to obtain required functional results as there is limited evidence regarding the differences in speech outcomes after palatoplasty in the past researches (2).

In most of the cases, surgical intervention will be required to treat VPI, for which certain techniques have been established and currently being used in craniofacial centers. The said surgeries can be pharyngeal flap, the sphincter pharyngoplasty, pharyngeal wall augmentation and the Furlow's Z-plasty (6). There exist disagreements on choice as regards diagnostic evaluation and surgical option most suitable for cleft palate (7) and hence requires further research.

The guidelines of American Cleft Palate Association's (ACPA) cleft palate and craniofacial anomaly teams including "Evaluation and Treatment Parameters" (1993) and "Parameters for Evaluation and Treatment of Patients with Cleft Lip/Palate or Other Craniofacial Anomalies" (2018), highlight the importance of adoption

of pre-operative and post-operative assessment of speech for determining the candidacy & outcomes of behavioral, surgical and prosthetic management of Velopharyngeal system. These include evaluation of articulation, nasopharyngoscopy, videofluoroscopy, aerodynamic measures and nasometry (8). However different craniofacial teams and centers prefer one surgical procedure over the other in the hope to provide better outcome. It is hard to compare success rates of different surgical interventions as there is no consistency in the methods used by different craniofacial professionals belonging to different clinical settings, for deciding the most suitable surgical method and describing speech results. Many craniofacial professionals normally base their evaluations on a person's own perceptual judgment resulting in bias. Even the results of speech assessments done pre- and post-operatively by speech and language therapists are based on their own perceptual evaluations. Thus, the reliability and quality of these evaluations' rests upon the assessor's professional bias and his/her experience. According to Kummer AW et al., there is significant variation in the evaluation methods and reporting speech results after surgical intervention with no consistent definition of success following surgery. Thus it becomes impossible to compare studies with majority of participants considering success as normal speech, however even this was not being practice (9).

Hence, keeping in view the variety of techniques in use for evaluation and intervention (9); & ACPA guidelines (8), current study was conducted to determine the common practices of craniofacial professionals in evaluating and reporting the speech outcomes after cleft palate and Velopharyngeal surgery. This research is of significant importance since it will highlight the issue of evidence based management of these cases and act a s research base for initiating further research and development in the treatment of Velopharyngeal dysfunction and cleft palate.

Methods

This cross-sectional study was conducted at Cleft Lip and Palate Association of Pakistan Hospital (CLAPP Hospital), and General Hospital Lahore over a period of six months from 1st July, 2021 to 31st December, 2021. A sample of N=96 craniofacial professionals was recruited using non-probability convenient sampling. Sample of craniofacial professionals included Speech-Language Pathologists, Plastic surgeons and Otolaryngologists of both genders, having at least 1-year experience of working in the field. Professionals who did not have experience of working with cleft palate patients were excluded from the study.

A sample size of N=96 was assessed using OpenEpi online calculator with prevalence of 2 (10), 1 million population, confidence level = 99.9%, and DEFF = 1.

Current study was started after obtaining ethical approval of research from Research Ethics Committee of Riphah International University vide Reference no. REC/RCR & AHS/21/0615 and consent of the craniofacial participants. Basic demographic sheet and a self-structured questionnaire comprising of 12 questions which determined the common practices of craniofacial professionals in evaluating and describing the surgical outcomes regarding speech following Velopharyngeal and cleft palate surgery. Expert opinion was obtained by professionals. For this purpose, question variables were put in content validation form to evaluate CVI that was 0.96 and Cronbach alpha value was 0.7.

Data was collected from the craniofacial professionals by visiting the hospital settings where they work with the patients who had undergone cleft palate and Velopharyngeal surgery. Some of the data was also collected by sending the same questionnaire online to the craniofacial professionals (SLPs, Plastic surgeons and Otolaryngologists).

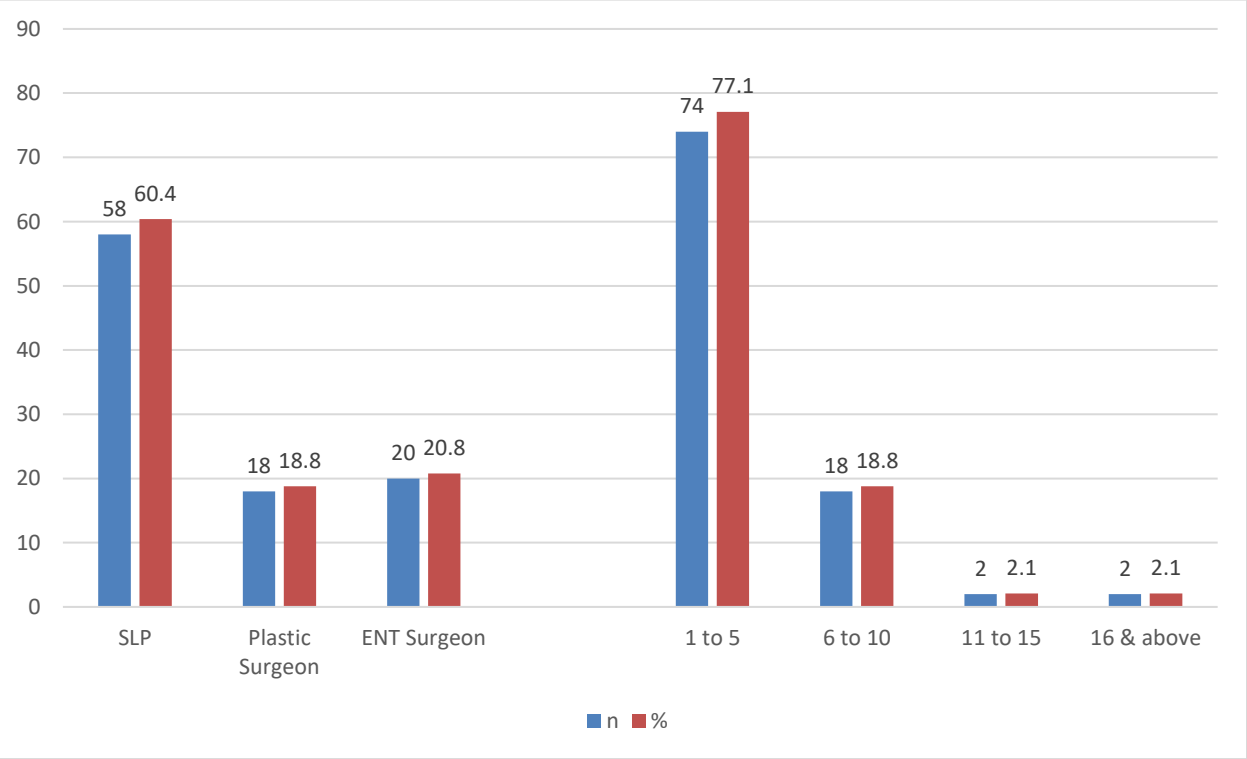
The data collected was analyzed using SPSS 21.0. (Inc. Chicago, USA). Descriptive statistics was utilized and frequency and percentage was calculated. Chi-square test used to see association of clinical variables with profession and experience. P<0.05 was considered significant.

Results:

Demographics:

Current study included N= 96 survey questionnaires filled online by professionals managing craniofacial anomalies with most 58 (60.42%) being Speech-Language Pathologists. (Fig 1)

Figure 1: Demographic Distribution of the sample (N=96)



Assessment:

Table 1 reveals response distribution of the participants. Majority 64 (66.7%) of the respondents reported that individuals who undergo VPI surgery undergo speech evaluation both pre and post-surgery with significantly (p=0.027) more otolaryngologists favoring evaluation after surgery (table 2).

Majority of the participants informed that speech assessment at their respective centers always contains perceptual assessment (85.4%) an intra-oral examination (89.6%) while 2.1% never include these assessment procedures in their speech evaluation & significantly more SLP's opted for perceptual (p=0.015) and intra oral examination (p=0.000).

More than 70% of respondents reported they either always or sometimes include nasometry and nasopharyngoscopy in their VPI evaluations with significant difference in opinion of different professionals with p= 0.000 & p=0.007 respectively; and different length of experience with p=0.044 and p=0.000 respectively.

More than two thirds of participants reported using aerodynamic measures as an assessment method sometimes (45.8%) or always (22.9%) while video fluoroscopic evaluation was reported being used sometimes (39.6%) and always (25%) by the participants with significant difference for different professions with p=0.000 and p=0.000 and experience with p=0.024 and p=0.027 respectively.

Table 1. Investigations & Clinical Features versus profession & experience. Cross tabulation. (N=96)

Investigations/ Tests	Response [n(%)]	Profession	Experience working with cleft lip and palate(in years)

			Speech Language Pathologist [58(60.42)]	Plastic Surgeon	Otolaryngologist	X2,P-Value	1-5 [74(77.03)]	6-10 [18(18.75)]	11-15 [2(2.03)]	16 & above [2(2.03)]	X2,P-Value
INVESTIGATIONS	Speech evaluation of the patients undergoing VPI surgery	Before surgery [4(4.2)]	2	0	2	11.01 0.027	4	0	0	0	7.85 0.249
		After surgery [28(29.2)]	16	2	10		26	2	0	0	
		Before and after surgery [64(66.7)]	40	16	8		44	16	2	2	
	Perceptual assessment	Always [82(85.4)]	54	14	14	12.39 0.015	62	16	2	2	1.331 0.07
		Sometimes [12(12.5)]	4	4	4		10	2	0	0	
		Never [2(2.1)]	0	0	2		2	0	0	0	
	Intra-oral examination	Always [86(89.6)]	56	18	12	34.19 0.000	66	16	2	2	1.15 0.979
		Sometimes [8(8.3)]	0	0	8		6	2	0	0	

		Never [2(2.1)]	2	0	0		2	0	0	0	
	Nasometry	Always [34(35.4)]	26	0	8	25.76 0.000	28	6	0	0	17.29 0.044
		Sometimes [36(37.5)]	24	8	4		28	8	0	0	
		Rarely [6(6.3)]	4	2	0		4	2	0	0	
		Never [20(20.8)]	4	8	8		14	2	2	2	
	Aerodynamic measures(pressure-flow)	Always [22(22.9)]	20	0	2	25.54 0.000	18	4	0	0	19.14 0.024
		Sometimes [44(45.8)]	26	8	10		36	8	0	0	
		Rarely [10(10.4)]	8	2	0		6	4	0	0	
		Never [20(20.8)]	4	8	8		14	2	2	2	
	Videofluoroscopy	Always [24(25.0)])	14	0	10	35.35 0.000	20	4	0	0	18.79 0.027
		Sometimes [38(39.6)]	30	6	2		30	8	0	0	

			Rarely [16(16.7)]	8	8	0		12	4	0	0	
			Never [18(18.8)]	6	4	8		12	2	2	2	
	Nasopharyngoscopy		Always [32(33.3)]	22	0	10	17.7 0.007	30	2	0	0	35.42 0.000
			Sometimes [36(37.5)]	20	8	8		30	6	0	0	
			Rarely [14(16.7)]	10	4	0		8	6	0	0	
			Never [14(14.6)]	6	6	2		6	4	2	2	
CLINICAL FEATURES	Hyper nasality	Hyper nasality	Absent [44(45.8%)]	20	6	18	19.86 0.000	32	10	0	2	4.94 0.176
			Present [52(54.2)]	38	12	2		42	8	2	0	
		Consistent, inconsistent, variable, or absent	Absent or Inconsistent/ variable [76(79.2)]	46	12	18	3.13 0.209	58	16	0	2	9.186 0.027
			Consistent [20(20.8)]	12	6	2		16	2	2	0	

		Severity	Absent or mild [46(47.9)]	32	8	6	3.88 0.143	42	4	0	0	10.76 0.013
			Moderate or severe [50(52.1)]	26	10	14		32	14	2	2	
		Use of Rating scale (such as 1–5)	No [84(87.5)]	48	18	18	3.88 0.144	64	16	2	2	0.673 0.88
			Yes [12(12.5)]	10	0	2		10	2	0	0	
		When a child has hypernasality, does it vary in severity due to utterance lewngth, effort or fatique.	No [22(22.9)]	18	4	0	8.12 0.017	18	4	0	0	1.27 0.735
			Yes [74(77.1)]	40	14	20		56	14	2	2	
	Nasal Emission	Presence	No [50(52.1)]	26	6	18	15.28 0.000	38	12	0	0	5.89 0.117
			Yes [46(47.9)]	32	12	2		36	6	2	2	
		Consistent, inconsistent,	No or inconsistent [70(72.9)]	46	12	12	3.25 0.197	52	16	0	2	8.71 0.033

		variable or absent	Consistent [26(27.1)]	12	6	8		22	2	2	0	
		Severity	No or mild [56(58.3)]	34	8	14	2.55 0.279	48	6	0	2	10.15 0.017
			Moderate or severe [40(41.7)]	24	10	6		26	12	2	0	
		Use of Rating scale (such as 1–5)	No [82(85.4)]	48	18	16	3.87 0.144	62	16	2	2	1.02 0.797
			Yes [14(14.6)]	10	0	4		12	2	0	0	

Table 2. Surgical treatment versus profession & experience. Cross tabulation. (N=96)

Investigations/ Tests			Response [n(%)]	Profession				Experience working with cleft lip and palate(in years)				
				Speech Language Pathologist [58(60.42)]	Plastic Surgeon	Otolaryngologist	X2,P-Value	1-5 [74(77.03)]	6-10 [18(18.75)]	11-15 [2(2.03)]	16 & above [2(2.03)]	X2,P-Value
SURGICAL	Surgical	Most commonly used surgical	Pharyngeal flap [72(75.0)]	48	16	8	46.57 0	56	14	0	2	98.17 0.000

		procedure to correct velopharyngeal dysfunction or VPI	Sphincteroplasty [(2(2.1)]	0	2	0		0	0	2	0	
			Pharyngeal augmentation [14(14..6)]	4	0	10		12	2	0	0	
			Furrow Z-plasty [2(2.1)]	0	0	2		2	0	0	0	
			Prosthetic device [6(6.3)]	6	0	0		4	2	0	0	
		Surgery for VPI in my practice/at my clinical setting is based on	Surgeons preferred procedure (same with all patients) [34(35.4)]	20	8	6	12.28 0.015	24	8	0	2	14.76 0.022
			Based on factors seen on endoscopy/videofluoroscopy (size,	30	4	14		42	4	2	0	

			shape, location of the gap) [48(50.0)]									
			Perceptual ratings of severity [14(14.6)]	8	6	0		8	6	0	0	
	Surgical "success" criteria at my center	Normal: Resonance is normal and there is no nasal emission	[22(22.9)]	18	2	2	27.57 0.000	20	2	0	0	24.15 0.004
		Acceptable: Speech is intelligible, but there is mild nasal emission	[28(29.2)]	18	2	8		20	6	0	2	
		Hyponasal: Mild hyponasality, but no	[14(14.6)]	2	4	8		12	0	2	0	

		evidence of VPI										
		Improved: Speech is better than it was, but still not normal to a casual listener	[32(33.3)]	20	10	2		22	10	0	0	
	Judgment of success	Speech-Language Pathologist	No [24(25)]	8	4	12	17.020	24	0	0	0	9.51
			Yes [72(75)]	50	14	8		50	18	2	2	0.023
		Treating Surgeon	No [56(58.3)]	36	10	10	0.962	44	12	0	0	6.15
			Yes [40(41.7)]	22	8	10	0.618	30	6	2	2	0.104
		Patient/Family	No [54(56.3)]	32	6	16	8.45	40	12	0	2	5.066
			Yes [42(43.7)]	26	12	4	0.015	34	6	2	0	0.167

As regards clinical findings, 54.2% professionals commented that noted hypernasality with significantly more SLP's indicating presence of hypernasality (p=0.000) and 76(79.2%) professionals were of the view that hypernasality was inconsistent or absent.

As regards severity, most 50(52.1%) reported that it was moderate or severe and it was association (p=0.013) with experience

Majority 84(87.5%) of professionals claimed that rating scale were not being used and majority professionals reported that hypernasality varied in severity due to utterance length and effort or fatigue, with association (p=0.017) with profession with all otolaryngologists agreeing to this.

As regards the clinical feature of Nasal Emission, 46(47.9%) reported its presence with significant association (P=0.000) with profession & most SLP's reported it and most Otorhinolaryngologists in negative. Consistent nasal emission was reported by 26(27.1%).

Severity wise moderate or severe nasal emission was reported by 40(41.75). Use of rating scale was reported only by 14(14.6%).

As regards surgical procedure (Table 2) which was most commonly used., majority 72 (75%) of the participants reported Pharyngeal flap as the "most commonly used " surgical procedure at their centers for correcting VPI and this revealed significant association (p=0.000) with profession with pharyngeal augmentation and Furlow's Z-plasty only reported by otolaryngologists ; and with experience.

Majority 48(50%) participants reported that surgery for VPI in respondents practice/ setting was based on factors seen on endoscopy/ videofluoroscopy and the response revealed significant association (p=0.015) with profession with otolaryngologists did not use perceptual rating of severity for the purpose; and experience (p=0.022) with perceptual rating was not in use by those having experience of > 11 years.

Surgical success criteria at participants center was reported by most as improved 32(33.3%) and it revealed significant association with profession (p=0.000) and experience (p=0.004)

Discussion:

The results of the present survey indicate a number of discrepancies between the assessment procedures, surgical choices, and methods to report outcomes after VPI surgery regarding speech, and the way surgical success is defined across cleft palate and craniofacial centers.

In current study most commonly (75%) performed surgical procedure as reported by the participants was Pharyngeal flap for correcting VPI and this revealed significant association (p=0.000) with profession with pharyngeal augmentation and Furlow's Z-plasty only reported by otolaryngologists. Vale F et al in their review noted that Furlow's Z-plasty and palatopharyngoplasty involving minimal invasive surgery as the most successful procedures (4), while according to Lindeborg MM et al., reported no significant difference in results as regards speech deficits after surgery for sphincter pharyngoplasty (SP), Pharyngeal flap(PF) and augmentation of posterior pharyngeal wall (2). In contrast, higher success rates were reported by De Seres LM et al., for sphincter phayrngoplasty with reduced risks of obstructive sleep symptoms (11) with resolution of VPI in 64% and improvement in 83% cases (12). Probably the responses in the current study in favour of pharyngeal flap are due to fear of Obstructive Sleep Apnea (OSA) in sphincter pharyngoplasty and since some studies indicate better results of pharyngeal flap compared to sphincteroplasty for eliminating hypernasality (13).

Up to the age of 3 to 4 years, clinical assessments of speech and resonance are considered gold standard evaluations, however after this age, assessments using instruments like nasometry, nasopharyngoscopy and videofluorosocpy give useful required data (14). A survey reported by Kummer AW et al., revealed that commonest evaluation procedures included in descending order of frequency were perceptual evaluation in

99.2%, intra-oral examination in 96.8%, nasopharyngoscopic examination in 59.35, nasometry in 28.9%, videofluoroscopic examination in 19.2% and aerodynamic procedures in 4.3% cases (5). Current study revealed that most (66.7%) of the respondents reported that individuals who undergo VPI surgery are evaluated both pre and post VPI surgery while as regards profession there was significant difference (p=0.027) in reporting this with more otolaryngologists favoring that evaluation after surgery was essential. For evaluation, most participants reported using perceptual assessment (85.4%) an intra-oral examination (89.6%) and profession wise most SLPS always opted for perceptual (p=0.015) and intra oral examination (p=0.000), examination compared to plastic surgeons and otolaryngologists. More than 70% of respondents also reported always or sometimes using nasometry and nasopharyngoscopy for evaluations. Also, only 25% of the respondents reported always including videofluoroscopy evaluations pre or postoperatively, while literature reveals that videofluoroscopy comes first to visualize Velopharyngeal function and this is followed by nasendoscopy for further evaluation (15). If craniofacial teams are not using the essential instruments for visualization of the Velopharyngeal port, then most of the surgical decisions are probably being made merely on the basis of subjective speech evaluations or surgeon's preference and experience, in spite of the fact that grounding surgical decisions on the Velopharyngeal closure pattern often leads to higher success rates in terms of speech outcomes (16).

Let's say the protocols used by craniofacial teams in evaluating VPI contains instrumental examination, even then one cannot depend solely on them for determining surgical success. Also, where all these instrumental measures are imperative for obtaining data about the level of severity of VPI and the structure and function of the Velopharyngeal port, the true assessment of surgical success relies upon individual's own perceptual assessment of the patient's speech after surgical management of VPI. However, it is important that an SLP who is well qualified to assess the function of Velopharyngeal port and also has knowledge about the resonance disorders should perform the perceptual assessment. Reason for this is that an SLP must decide if there is

hyponasality, hypernasality or nasal air emission and should be able to ignore the effects of faulty articulation (17).

Results of current study show that only 25% of participants reported using videofluoroscopy whereas more than 70% of respondents reported them either always or sometimes include nasometry and nasopharyngoscopy in their evaluations. It means that craniofacial professionals believe that they are obtaining enough information required for surgical decision-making for VPI and also regarding the function of Velopharyngeal port through visualization by nasopharyngoscopy. That is why, maybe, they are unwilling to perform videofluoroscopy as well. Although, videofluoroscopy can supplement nasopharyngoscopy findings because it provides additional information about the degree of Velopharyngeal movement and closure. According to Golding-Kushner KJ and the ACPA's parameters and guidelines (1993, 2000), both videofluoroscopy and nasopharyngoscopy should be used whenever possible to obtain the most comprehensive information about an individual's Velopharyngeal structures and functioning (18). Identification of clinical examination and imaging to accurately predict successful repair of VPI requires further research (19).

According to de Blacam C et al., around 70% cases achieve normal resonance while 65% get normal nasal emission (3). While in the current study, 54.2% professionals commented that hypernasality was present, with significantly more SLP's indicating that hypernasality was present (p=0.000), however no significant difference was noted for experience. Most professionals 76(79.2%) were of the view that hypernasality was inconsistent or absent with significant (p=0.027) difference with experience. As regards severity, most (52.1%) reported that it was moderate or severe & it revealed association (p=0.013) with experience with all professionals having > 11 years' experience reported it was moderate or severe. Rating scale to assess hypernasality were not in use (87.5%). When response to question that when a child has hypernasality does it vary in severity due to utterance length, effort or fatigue, majority (77.1%) reported yes it does and this revealed

association (p=0.017) with profession with all otolaryngologists agreeing to this. As regards the clinical feature of Nasal Emission, 47.9% reported its presence with significant association (P=0.000) with profession with most SLP's reported in affirmative and most otolaryngologists in negative. Consistent nasal emission was reported by 27.1% with no association with profession, however it was associated (p=0.033) with experience. Severity wise moderate or severe nasal emission was reported by 40(41.75) with association with experience. Most of the craniofacial professionals managing VPI would approve that the elimination of nasal emission and hypernasality, without leading to airway obstruction and hyponasality, is the ultimate goal of the surgery for VPI. A study by Witt PD et al. labelled success as normal resonance, non-existent sleep apnea, total closure of Velopharyngeal port and patent upper respiratory tract (20). This finding is in consistent with the literature, that that there is no universally accepted way to define success following VPI surgery. Several studies have acknowledged this problem, indicating that it can mislead and create confusion when comparing results across centers or between procedure (20, 21).

In current study use of rating scale was reported by 14.6% with no association with profession and experience. It was thus quite evident from the results of this study that there is a need for a standard perceptual rating system across cleft palate and craniofacial teams. While almost all participants of this survey reported using perceptual ratings, pre- and postoperatively to assess speech, there is no standard to report the results of these ratings. However, literature reveals formal protocols and rating scales that are suggested which like e Cleft Audit Protocol for Speech (22).

There is no consistency in the methods used by different craniofacial professionals belonging to different clinical settings, for determining the appropriate surgical procedure and reporting the speech outcomes (16, 23, 24). This is undoubtedly evident from the results of this present survey. Better surgical outcome is only possible with better anatomical and functional understanding and multimodal approach in patient assessment (25).

Conclusion:

It is concluded that there is inconsistency in the definition of success across centers and among craniofacial professionals and there is also marked inconsistency in the way speech outcomes are being evaluated and reported. Thus, in order to progress further to improve speech outcomes there should be a reliable speech assessment protocol to evaluate the Velopharyngeal function. This would permit us to make relevant and meaningful comparisons between the procedures, the surgeons, and the clinical centers which can contribute in determining which procedures actually result in the best speech outcomes for variety of patients with cleft palate and Velopharyngeal insufficiency.

Ethical Considerations:

Ethical issues including informed consent, plagiarism, misconduct etc. have been completely observed by the authors.

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