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Review

Management of cleft palate among patients with Pierre Robin sequence

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Abstract

Pierre Robin Sequence (PRS) is a congenital craniofacial anomaly distinguished by the presence of micrognathia, glossoptosis, and upper airway obstruction. Cleft palate occurs in over 3/4 of patients with PRS. The wide U-shape cleft and airway dysfunction create challenges in clinical management. Currently, disputes exist on the treatment protocol and prognosis of cleft palate management among patients with PRS. This review is focused on the deformity features, intervention timing, technique selection, airway support, and outcome evaluation of cleft palate among patients with PRS, aiming to provide reference to further evolution in the management of PRS-related cleft palate.

Keywords: Cleft palate; Surgical management; Airway obstruction; Speech; Growth

Introduction

Pierre Robin sequence (PRS) is a congenital craniofacial malformation with a birth occurrence of between 1/14000 and 1/8000,[1] and is mainly characterised by micrognathia, glossopotosis, and airway obstruction. More than 40 syndromes have been associated with PRS, which itself is divided into a syndromic type (sPRS) and a non-syndromic type (nsPRS).

More than 3/4 of patients with PRS demonstrate cleft palate (CP), which is typically wide and U-shaped. It has been hypothesised that micrognathia hinders the downward transposition of the tongue and subsequently blocks the elevation and fusion of palatal shelves, resulting in defects wider than isolated cleft palate (ICP). The wider defect of the cleft, along with limited mouth opening due to micrognathia, makes surgical repair and the subsequent wound healing and speech outcomes more challenging.[2]

Other factors affecting perioperative management may be present among patients with PRS, of which respiration and nutrition are the most prominent. Micrognathia and glossoptosis may lead to difficult intubation and an increase in perioperative respiratory complications. Malnutrition and developmental delay consequent to feeding difficulties are related to risks during general anaesthesia and unsatisfactory wound healing. All these problems associate PRS-related CP with a higher risk of perioperative complications, delayed timing of surgery, and compromised outcomes.[3]

The inconsistency over the diagnostic criteria and the phenotypic variation has significantly limited comparability among studies on PRS-related CP. Currently, there is no unified CP treatment protocol for patients with PRS. Here, we have comprehensively reviewed the perioperative complications and outcome evaluation of PRS-related CP reported in the literature, and discussed the timing of surgery, neonatal airway support as well as other potential prognostic factors, aiming to provide reference to the improvement of CP management for patients with PRS.

Pathological characteristics of cleft palate among patients with Pierre Robin sequence

The cleft type among patients with PRS is mostly hard and soft cleft palate (Veau type II). Some researchers have associated smaller mandibular length with a greater extent of cleft

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in the sagittal direction. Compared with ICP, patients with PRS usually demonstrate wider CP but no significant difference has been found, to our knowledge, in width of the dental arch, depth of the nasopharynx, or the length of the hard and soft palates.[4] Wider clefts have been associated with more severe airway and feeding problems. Patients with PRS often demonstrate palatal vault and lingual bone abnormalities, and early evaluation of palatal and lingual bone morphology may help predict the prognosis of surgery and the need for airway or feeding intervention.

Determining the timing of palatal repair

For ICP, it is generally accepted that primary palatoplasty should be performed before 18 months after birth, to restore normal velopharyngeal function for speech development and avoid compensatory articulation error. For patients with PRS, however, the CP repair requires more comprehensive evaluation, and currently no conclusion on the optimal timing has been reached yet. Perioperative safety issues for CP management among PRS patients mainly include three aspects:

Difficult intubation

Micrognathia and glossoptosis affect the vision and access for intubation especially when endoscopic assistance is unavailable, and multiple intubation attempts increase the risk of laryngeal oedema. Also, patients with PRS may present with abnormal development of laryngeal cartilage or tracheal stenosis, which further increases the difficulty of intubation and intraoperative airway maintenance.

Postoperative respiratory complications

Studies have shown a much higher incidence of anaesthetic complications among children with PRS and thus Henriksson and Skoog suggested postponing CP repair for patients with signs of airway obstruction till 18 months.[5] Van Lieshout et al performed delayed palate closure among children with PRS but still reported airway problems in 30% of their cases.[6] On the other hand, de Buys Roessingh et al. believed that if airway obstruction was fully relieved by continuous positive airway pressure mask, CP repair could be delivered at the same time as patients with ICP.[7] Otherwise, further airway intervention should be considered before CP repair. Costa et al took apnoea hypoxia index (AHI) greater than 5 as a contraindication of CP surgery and reported a similar rate of postoperative complications between patients with PRS and ICP.[8] Other researchers, however, reported no correlation between preoperative polysomnography results and postoperative complication occurrence.

Nutrition

Affected by glossoptosis and CP, most children with PRS present varying degrees of feeding difficulty, leading to poor nutrition and growth retardation. Up to 11.9 % of PRS patients still suffer from feeding difficulties at the time of CP repair. Filip et al found a decrease in the incidence of feeding difficulty at the time of CP repair, but did not show a growth spurt in the first year of life.[9] Reid et al. also revealed that poor feeding did not entirely resolve at the age of 14 months. Low weight gain usually indicates immature anatomical and physiological development, which affects the tolerance to anaesthetics and surgical operations.[10]

At present, there is no consensus on the optimal timing of CP repair for patients with PRS. Clinicians must take all the above factors into consideration and individually evaluate the gain and risk. Patel et al reported a significantly increased rate of velopharyngeal insufficiency (VPI) when CP repair was performed after 15 months after birth among patients with PRS.[11] Thus, most centres support in-time CP repair once the airway is secured. The average age at PRS-related CP repair reported in the literature ranged between 7.28 to 20.6 months (Table 1). Close postoperative monitoring can never be overemphasised since palatoplasty and postoperative oedema would further narrow the airway.

Influence of neonatal airway support on cleft palate repair

The severity of airway obstruction in PRS patients is usually evaluated through clinical manifestations, as well as by monitoring with pulse oximeter and polysomnography (PSG). Non-surgical options for patients with moderate to severe airway obstruction include the use of nasopharyngeal airway (NPA), Tübingen palatal plate (TPP), and continuous positive airway pressure ventilation. Surgical options include tongue-lip adhesion, tracheostomy, and mandibular distraction osteogenesis (MDO).

The NPA is an effective temporary measure in which the endotracheal tube is inserted through one nostril and placed above the epiglottis to bridge narrowing of the pharyngeal space. However, NPA does not stimulate mandibular growth or position the tongue more horizontally. The TPP is effective in treating both mild and severe forms of isolated and syndromic PRS. Additionally, it has been associated with mandibular catch-up growth by keeping the tongue in a normal position and correcting the anatomical defects in patients. However, there is still a lack of relevant research on its effect on cleft palate surgery.

Mandibular distraction osteogenesis has become a major surgical method for correcting upper airway obstruction caused by micrognathia in neonates. It offers several advantages over traditional methods, including fewer short-term complications, shorter hospital stays, and less burden on patients and their families. The purpose of MDO surgery is to move the mandible and tongue forward, increasing airway volume to relieve airway obstruction.[12]

Some studies have suggested that the force exerted on the tongue may be transferred to the cleft, causing an increase in tension or possibly even widening of the cleft. Prescher et al analysed rates of postoperative fistula and found that MDO did not make the cleft more favourable for closure.[13] However, other studies have found that patients receiving MDO

Table 1
Summary of studies comparing postoperative speech outcomes after repair of Peirre Robin sequence (PRS) cleft palate.

First author, year and reference	Study design	Neonatal airway support	Number of patients			Surgical method	Patients' age during cleft palate repair (months old) mean and (range) or (SD)			Postoperative VPI rate (%)			Postoperative VPI surgery rate (%)			Hypernasality	Hyponasality	Nasal emission	Articulation errors	Predictive factors
			sPRS	nsPRS	iCP		Study group	Control group	Difference	Study group	Control group	Difference	Study group	Control group	Difference					
Basta, 2014[31]	sPRS vs. nsPRS	38.6 (17/44)	44	0	-	Furlow Z-plasty	20.6 (6-154)	-	-	28.6	6	↑	13.6 (6/44)	8.1	↑	-	-	-	-	-
Lehman, 1995[15]	PRS vs. iCP	16.6 (6/36)	6	30	135	-	16.2 (10.2-26.5)		ns	35.7 (12/34)		ns	17.4 (6/34)		ns	ns	ns	↑	ns	-
Logjes, 2021[25]	PRS vs. iCP	40.0 (30/75)	41	34	83	Straight-line repair with intravelar veloplasty (SLIV). OR Furlow.	13.7 (5.3)	11.3 (5.1)	↑	41.0 (18/44) sPRS: 60.0 (15/25) nsPRS: 16.0 (3/19)	17.0 (8/47)	↑	16 (36)	4 (9)	↑	ns	-	-	↑	Cleft anatomy: the only independent factor
Hardwicke, 2016[26]	Paired PRS vs. iCP	100.0 (24/24)	3	21	24	Intravelar veloplasty bipedicled von Langenbeck flaps when required	7.9	11.3	ns	-	-	-	41.6 (10/24)	8.3 (2/24)	↑	Worse nasality scores in PRS group, worse cleft speech characteristic scores in PRS group				Neonatal airway support
Roessing, 2008[7]	sPRS vs. nsPRS	8 (21.1%)	13	25	0	2 flap?	7.28 (1.8)	6.95 (1.56)	-	-	-	-	23.1 (3/13)	36.0 (9/25)	ns	-	-	-	-	None
Gustafsson, 2020[27]	nsPRS vs. iCP	91.0 (71/78)	0	78	-	Veau-Wardill-Kilner technique Bardach 2-flap technique von Langenbeck technique Mendoza technique	10 (6-16)	-	-	-	-	-	47.4 (37/78)	-	↑	-	-	-	-	None
Taku, 2020[21]	nsPRS vs. iCP	6.7 (1/15)	0	15	40	2000-2002:push-back palatoplasty from 2002: modified Furlow	18.5 (15-23)	16.8 (12-23)	↑	20.0 (3/15)	7.5 (3/40)	ns	5 (33.3%)	5 (12.5%)	ns	ns	-	ns	-	None
Kocaaslan, 2020[28]	PRS vs. iCP	6.8 (4/59)	0	59	132	-	14 (6-26)	13 (6-21)	ns	25.4 (15/59)	7.6 (10/132)	↑	-	-	-	-	-	-	-	None
Witt, 1997[30]	sPRS vs. nsPRS	-	24	34	0	Intravelar veloplasty	18.5	14.9	-	8.3 (2/24)	44.1 (15/34)	↓	-	-	-	-	-	-	-	
Patel, 2012[11]	sPRS vs. nsPRS	-	29	67	0	-	13.0 (8.5-74.2)	10.1 (7.0-20.2)	ns	37.9 (11/29)	16.4 (11/67)	↑	-	-	-	-	-	-	-	None
Stransky, 2013[24]	PRS vs. iCP	27.3 (15/55)	0	55	129	Modified Furlow	13 (8-29)	12 (3-108)	↑	16.4	8.5	↑	20.0	12.4	ns	↑	-	ns	ns	None
Goudy, 2011[22]	Paired PRS vs. iCP	-	0	21	42	3-flap plasty	14.2 (12-18)	12.5 (11-14)	-	23.5	21.9	ns	14.3 (3/21)	23.8 (10/42)	ns	ns	ns	-	-	-
Morice, 2018[29]	sPRS vs. nsPRS	few	34	96	0	One-stage (65.5%): Sommerlad two-stage (34.5%): Sommerlad, vomerine flap with lateral incisions	one-stage: 8 (3.2) two-stage: 8 (2.5), 15 (2.5)	one-stage: 6 (1) two-stage: 6 (1.3), 15 (3.2)	one-stage: ↑ two-stage: ns	52.9 (18/34)	30.2 (29/96)	↑	32.4 (11/34)	22.9 (22/96)	ns	-	-	-	-	None
Kholsa, 2008[23]	PRS vs. iCP	-			88	Furlow Z-plasty	12 (6-78)	12 (6-78)	-	8.8 (3/34)	19.3 (17/88)	ns	2.9 (1/34)	1.1 (1/88)	-	ns	-	ns	ns	None
Filip, 2015[9]	PRS vs. iCP	18.3 (19/104)	11	93	878	Modified von Langenbeck: 36.6(38/104) Sommerlad: 63.5 (66/104)	14.5 (6.5)	-	-	57.5 (55/87)	19.4	↑	nsPRS: 33.3 (31/93) sPRS: 45.5 (5/11)	19.4 (68/351)	↑	-	-	-	-	None
	sPRS vs. nsPRS	-				Modified von Langenbeck or Sommerlad	14.5 (6.5)	-	-	-	-	-	45.5 (5/11)	33.3 (31/93)	ns	-	-	-	-	

VPI = velopharyngeal insufficiency; ns = no significant difference; - = not mentioned or not included in the study; ↑ =the numerical value is higher in study group; ↓ = the numerical value is higher in study group; sPRS = syndromic Pierre Robin sequence; nsPRS = non-syndromic Pierre Robin sequence; iCP = isolated cleft palate.

had both a lengthening of the soft palate and a narrowing of the cleft, making subsequent CP surgery easier.[14]

However, the significant reduction in the surface area of retropalatal space and airway volume after CP repair may reverse the airway volume improvement made by MDO, making it difficult to determine the optimal timing of CP repair. Therefore, it has been suggested by some surgeons that CP repair should be delayed to avoid potential respiratory complications.[13,15]

In summary, the choice of surgical or nonsurgical intervention for PRS depends on the severity of the airway compromise. Conservative treatment options such as NPA or TPP may be applicable in a wide range of cases. Mandibular distraction osteogenesis is currently the main surgical approach for PRS, but it is not necessarily the first line of therapy. Both non-surgical and surgical interventions can improve breathing in infants with PRS, but subsequent CP repair may affect breathing, making it challenging for surgeons to determine the optimal timing of repair.

Cleft palate repair techniques for patients with Pierre Robin sequence

The goals of primary CP repair are to close the cleft and restore normal velopharyngeal function, while minimising negative influence on craniofacial growth. For patients with PRS, further consideration must be given to the potential impact of velopharyngeal anatomical changes on ventilation.

For hard palate closure, the characteristic U-shaped wide cleft among patients with PRS usually requires bilateral relaxing incisions on the mucoperiosteum. Some surgeons adopt two-stage surgery to postpone hard palate closure. Bütow et al believed that the repaired velum would push the tongue forward and downward, alleviating airway obstruction caused by glossoptosis, and the width of hard palate cleft would decrease after velum repair.[16] Currently, however, there are no concrete data supporting the theory that velum repair leads to changes in tongue position and ventilation function in patients with PRS. Therefore, most centres still adopt one-stage palatoplasty for patients with PRS.

As for soft palate repair, velar lengthening and muscle sling restoration have been recognised as effective manoeuvres for improving postoperative velopharyngeal function. Commonly used techniques include the Furlow double-opposing Z-plasty (DOZ) technique and Sommerlad radical intravelar veloplasty technique. For the DOZ technique, many are concerned that significant velum lengthening and nasopharyngeal port narrowing may increase the risk of postoperative dyspnoea among patients with PRS.[17] Opdenakker et al. reported that the incidence of dyspnoea after DOZ repair was 15% in patients with PRS and 3% in ICP patients.[18] Antony et al reviewed 247 patients who underwent the DOZ procedure, and found 50% of patients who experienced airway obstruction within 48 hours after surgery were those with PRS.[19] Compared with the DOZ technique, the Sommerlad technique does not directly increase the overall length of the velum and is theoretically of fewer airway risks.[20] Filip, however, found no significant difference in postoperative VPI rate between the two techniques in patients with PRS.[9] Based on the observation that PRS-related CP yielded worse speech outcomes than ICP, Patel et al. even proposed to apply a pharyngeal flap as the primary procedure for patients with PRS who demonstrate no obvious airway obstruction.[11]

So far, there is no sufficient research work to support the definitive advantages of any technique over the others, in general, most centres still adopt one-stage palatoplasty as few studies suggest ventilation improvement and tongue repositioning after velum repair. For soft palate repair, some concern that the DOZ technique may lengthen the velum and increase the risk of postoperative respiratory complications among patients with PRS, but there is still a lack of evidence to support this.

Postoperative outcomes of cleft palate repair in patients with Pierre Robin sequence

The outcome evaluation of CP repair requires long-term follow up and covers aspects including postoperative oronasal fistulae, velopharyngeal function, middle ear function, and craniofacial growth. The particular cleft features and growth patterns in the palatopharynx and overall craniofacial region correlated with PRS may exert significant influence on the outcome of CP management. Current studies on CP outcomes among patients with PRS could be classified into two groups: comparison between patients with PRS-CP and ICP, or comparison between patients with sPRS or nsPRS.

Speech outcomes

As listed in Table 1, several studies comparing PRS-CP and ICP reported no significant difference in velopharyngeal function or speech performance after primary palatoplasty.[15,21] Using the three-flap technique, Goudy et al reached 76.74% and 78.13% velopharyngeal competence rates for PRS-CP and ICP, respectively, and found no difference in the incidence of hypernasality or hyponasality.[22] Similarly, Khosla et al. showed PRS-CP and ICP repaired using Furlow's technique demonstrated no difference in hypernasality, nasal escape, or VPI, and suggested no correlation between speech outcome and age at surgery, cleft severity, or surgeon experience.[23]

In contrast, an equal amount of literature suggested less satisfactory speech outcomes for PRS-CP than ICP.[9,24,25] In a matched case-control study, patients with nsPRS demonstrated higher scores in nasality and cleft speech characteristics and a higher rate of secondary surgery than those with ICP.[26] The study suggested that patients requiring airway support may expect worse speech outcomes. Gustafsson et al reviewed cases repaired by a variety of techniques and found a higher incidence of VPI among patients with PRS, and the difference was not correlated with gender, sur-

Table 2
Summary of studies comparing postoperative fistulae rates after repair of Peirre Robin sequence (PRS) cleft palate.

First author, year and reference	Study design	Neonatal airway support	Number of patients			Surgical method	Patients' age during cleft palate repair (months old) mean and (range) or (SD)			Postoperative fistula rate (%)			Predictive factors
			sPRS	nsPRS	iCP		Study group	Control group	Difference	Study group	Control group	Difference	
Basta, 2014[31]	sPRS vs. nsPRS	38.6 (17/44)	44	0	-	Furlow Z-plasty	20.6 (6-154)	-	-	2.3 (1/44)	-	-	-
Lehman, 1995[15]	PRS vs. iCP	16.6 (6/36)	6	30	135		16.2 (10.2-26.5)		ns	11.8 (4/34)		ns	
Logjes, 2021[25]	PRS vs. iCP	40.0 (30/75)	41	34	83	Straight-line repair with intravelar veloplasty (SLIV) OR Furlow	13.7 (5.3)	11.3 (5.1)	↑	5.3 (4/75)	0	↑	Diagnosis of PRS
Hardwicke, 2016[26]	Paired PRS vs. iCP	24 (100%)	3	21	24	Intravelar veloplasty + von Langenbeck if necessary	7.9	11.3	-	4.2 (1/24)	16.7 (4/24)	ns	
Gustafsson, 2020[27]	nsPRS vs. iCP	91.0 (71/78)	0	78	-	Veau-Wardill-Kilner technique Bardach 2-flap technique von Langenbeck technique Mendoza technique	10 (6-16)	-	-	24.4 (18/78)	-	-	None
Taku, 2020[21]	nsPRS vs. iCP	6.7 (1/15)	0	15	40	2000-2002:push-back palatoplasty from 2002: modified Furlow	18.5 (15-23)	16.8 (12-23)	↑		2.5 (1/40)		
Kocaaslan, 2020[28]	PRS vs. iCP	6.8 (4/59)	0	59	132	-	14 (6-26)	13 (6-21)	ns	13.6 (8/59)	9.1 (12/132)	ns	None
Patel, 2012[11]	sPRS vs. nsPRS	-	29	67	0	-	13.0 (8.5-74.2)	10.1 (7.0-20.2)	ns	7 (3)	6 (5)	-	
Stransky, 2013[24]	PRS vs. iCP	15 (27.3%)	0	55	129	Modified Furlow	13 (8-29)	12 (3-108)	↑	0	5.4	ns	
Goudy, 2011[22]	Paired PRS vs. iCP	-	0	21	42	3-flap plasty	14.2 (12-18)	12.5 (11-14)	-	9.5 (2/21)	7.3 (3/42)	-	
Morice, 2018[29]	sPRS vs. nsPRS	-	34	96	0	One-stage (65.5%): Sommerlad two-stage (34.5%): Sommerlad, vomerine flap with lateral incisions	One-stage: 8 (3.2) two-stage: 8 (2.5), 15 (2.5)	One-stage: 6 (1) two-stage: 6 (1.3), 15 (3.2)	One-stage: ↑ two-stage: ns	23.5 (8/34)	27.1 (26/96)	ns	Cleft type
Filip, 2015[9]	PRS vs. iCP	18.3 (19/104)	11	93	878	Modified von Langenbeck: 36.6 (38/104) Sommerlad: 63.5 (66/104)	14.5 (6.5)	-	-	4.8 (5/104)	4.1 (36/878)	ns	-

↑ = the numerical value is higher in study group; ↓ = the numerical value is higher in study group; ns = no significant difference; sPRS = syndromic Pierre Robin sequence; nsPRS = non-syndromic Pierre Robin sequence; iCP = isolated cleft palate.

geon, age at primary palatoplasty, surgical technique, cleft severity, or neonatal airway management.[27] Kocaaslan et al. found a higher VPI rate for Veau II cleft among patients with ICP but not among those with PRS-CP.[28]

Contradictory data also exist in studies comparing patients with sPRS and nsPRS. While most reports found no difference in speech outcome between the two groups,[7] Patel et al believed patients with sPRS had worse postoperative speech outcomes than those with nsPRS.[11] Morice et al. reviewed PRS-CP repaired using the Sommerlad technique and reported a higher incidence of VPI among patients with sPRS than nsPRS, and the difference was not associated with the severity of PRS symptoms, cleft width, or soft palate electromyography.[29] Surprisingly, Witt et al[30] and Basta et al[31] reported a higher rate of VPI among patients with nsPRS than sPRS.

Fistula occurrence

Fistula is a complication difficult to manage after palatoplasty. Its occurrence has been associated with factors including cleft severity, surgical procedure, surgeon experience, nutritional status, and perioperative infection.

The wide U-shape of the PRS-CP is an obvious feature potentially associated with occurrence of fistulae. Parwaz et al. proposed cleft width over 15mm and cleft width/dental arch width ratio over 0.41 as predictors of higher risk of fistula formation.[32] Gustafsson et al reported a higher postoperative fistula rate in PRS-CP than in ICP, and the most common site for PRS-related fistula was the hard and soft palate border.[27] Most other studies, however, found no significant difference in fistula rate between PRS-CP and ICP.[9,24,26,28,29] The literature reported postoperative fistula rates ranging from 2.3% to 24.4% among patients with PRS (Table 2).

Hearing and middle ear function

Middle ear disease and hearing impairment are common among patients with CP as a consequence of Eustachian tube (ET) dysfunction. Hearing loss in patients with PRS-CP was usually conductive, bilateral, and more common than in patients with ICP.[33]

The ET function usually improves with age and an increase in the size of mastoid air cell system (MACS) is indicative of enhanced ET function. Handzi -Cuk et al. compared the process of mastoid pneumatisation in patients with PRS-CP and ICP and associated the former with significantly smaller MACS size. They observed that the degree of mastoid pneumatisation increased during aging among patients with ICP but not those with PRS-CP, which may be correlated with continuous mandibular hypoplasia and glossoptosis.[34]

In all of Handzi -Cuk et al's cases, hearing was restored to a normal level through suction and the use of ventilation tubes. According to Yang et al., early CP closure demonstrated a highly positive impact on the hearing function.[35]

Craniofacial growth

Although iatrogenic factors have been recognised as the major source of maxillary growth arrest associated with CP deformity, abnormal intrinsic growth potential may play a more important role among patients with PRS in craniofacial morphology. In addition, open bite caused by micrognathia and mouth breathing consequent to airway obstruction may lead to secondary growth deformity in maxillae. It is still controversial whether there is mandibular catch-up growth and whether catch-up growth may completely compensate for congenital mandibular hypoplasia.

Krimmel et al assessed the three-dimensional facial morphology of patients with operated PRS-CP and unaffected children and found that both the mandible and the midface were highly affected.[36] Shen et al found that children with PRS-CP and those with ICP both showed smaller maxillary lengths compared to normal controls. The crossbite was less severe in patients with PRS-CP since the mandible was more recessive.[37] Laitinen et al. showed that the craniofacial morphology between patients with PRS-CP and ICP was similar except for more recessive mandibles in PRS-CP.[38] The intermaxillary relationship remained constant during the follow-up period, indicating no obvious catch-up growth in the mandible.[38] Do et al reported that 41% of patients with PRS who underwent von Langenbeck surgery at the age of 10-13 months developed class-III malocclusion, and suggested a positive correlation between cleft width and maxillary retrusion severity.[39] Caillot et al compared patients with PRS-CP and ICP repaired by the Sommerlad technique. They found smaller SNA angles in patients with PRS at the age of 4-7 years but no difference in the SNB angle between the two groups.[40] Moreover, they found that early closure (6 months) of the soft palate resulted in identical mandibular growth in patients with PRS compared to postponed closure (12-18 months).

Conclusion

Management of CP among patients with PRS requires more comprehensive consideration than ICP. Significant disputes exist in the treatment protocol and prognosis of PRS-CP. Discrepancy in inclusion criteria, surgical techniques, treatment timing, and evaluation standards compromise comparability among current studies. Nevertheless, existing experience indicates that early CP repair for PRS patients is possible, and we may expect satisfactory outcomes with detailed preoperative examination, individualised treatment planning, and a multidisciplinary team approach.

Ethics statement/confirmation of patient permission

Not required.

Conflict of interest

We have no conflicts of interest.

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