Asymmetrical soft palate cleft repair: Preliminary results

K.-W. Bu tow, H. Engelbrecht, S. Naidoo

Facial Cleft Deformity Clinic, Department of Maxillo-Facial and Oral Surgery, University of Pretoria, South Africa

Abstract.

The reconstructions of the asymmetrical soft palate cleft is a surgical challenge when it comes to achieving symmetry and optimal soft palate muscular function. Three different versions of the intravelar veloplasty have been used: the intravelar veloplasty (1969) (type I), the modification according to anatomical defects (1991) (type II), and the modification using part of Sommerlad's technique and part of Ivanov's technique (2008) (type III). The perioperative outcomes of the type II and type III intravelar veloplasty were assessed and compared in asymmetrical cleft cases. Two hundred and seventy-seven soft palate clefts were reconstructed: 153 type II and 124 type III. Of these, 49 were asymmetrical (17.7%); 23 underwent the type II procedure and 26 the type III procedure. Of the type II procedure cases, 30.4% remained asymmetrical postoperatively compared to 3.8%of the type III cases. The uvula appeared subjectively atrophic in 47.8% of the type II cases and in 7.7% of type III cases. Oro-nasal fistula occurred in 13.0% of the type II cases and 3.8% of the type III cases. Speech results will only be assessed after 4 years of age. The type III modified intravelar veloplasty has had a major beneficial impact on patients who had an asymmetrical soft palate cleft.

Keywords: soft palate cleft; asymmetrical cleft; intravelar veloplasty..

The soft palate cleft repair is an integral part of the modern cranio-maxillofacial surgical spectrum. It is especially challenging in light of the importance of optimization of velopharyngeal competency (resulting from insufficient and malformed tissue at the cleft site). Speech development is an important consideration when choosing a specific surgical technique for closure of the cleft, as well as the age at which the surgery should be performed.[1,2] With any type of procedure in repairing the soft palate cleft, the surgeon and speech pathologist are frequently confronted with a short soft palate and a wide velopharyngeal space, both of which are known to diminish the quality of speech.[3] This is of particular significance in an asymmetrical soft palate, where there can be a marked difference in the amount of tissue available on either side of the cleft to utilize in reconstruction.

Soft palate repair techniques have undergone a metamorphosis over the centuries. The first successful closure by approximating the cleft margins was apparently performed by Le Monnier (France) in 1766. In 1931, Veau took palatal musculature into account and suggested closure of the muscular layer, without considering the orientation of the musculature.[4] This inadequate muscular function led to the concept of levator muscle dissection and rotation,[5] and finally to a more thoughtful anatomical approach to muscular influence on functionality and the development of the well-known intravelar veloplasty.[6] This was described by Kriens (1969) and is referred to as the type I intravelar veloplasty. It entails the dissection of the cleft margins in the sagittal plane with medial deflection of the dissected margins to meet centrally and thus form the nasal mucosal layer. The levator muscle is dissected loose from the palatal bone, rotated, and sutured centrally. The uvulas are dissected and sutured centrally. The hamulus is fractured inwards and the tensor muscle and tendon is stripped

off. The oral mucosal layer is approximated and releasing incisions are placed laterally. This technique was performed in the facial cleft deformity clinic until 1987. Thereafter it was modified according to anatomical defects[7] (the type II intravelar veloplasty) and included uvula muscle repair.[8] This change included seven different modifications to the original intravelar veloplasty. Similarly to the type I repair, the nasal layer is reconstructed following sagittal dissection of the cleft margins. Muscular reconstruction is done and a tensor sling is included to place the tensor muscle tendons under maximal tension, in order to facilitate improved Eustachian tube function. The hamulus is not fractured. Various triangular flaps, releasing incisions, and back-cuts are utilized to relieve tension, depending on the anatomical deformity present. In 2008, a further modification was made to the type II procedure using part of Sommerlad's technique,[9] part of Ivanov and Agueeva's technique,[10] and changes to the handling of the paired uvula muscle – the type III intravelar veloplasty. With the type III intravelar veloplasty, in addition to the type II modifications, the levator muscle is dissected and reconstructed, facilitating posterior repositioning. The palatoglossal–palatopharyngeal muscle bundle is dissected and approximated centrally. Both uvulas are not dissected, with one uvula (from the shorter cleft side) being preserved and centralized, whilst the longer uvula is dissected and inserted as a triangular flap into the nasal mucosal layer. Since 2008, this type III veloplasty has been used as the standard approach for the repair of the soft palate cleft.

The asymmetrical soft palate cleft (Fig. 1) presents a major concern for the surgeon. The symmetrical and asymmetrical appearances were recorded by gross observation. The cleft must ideally be repaired so that the muscles are aligned and sutured (myopexy) as a perfect func-tional unit. This article describes new modifications to the standard intravelar veloplasty, which have previously not been described in conjunction with one another. This study entailed the evaluation of the incidence of asymmetrical soft palate cleft, the repair procedure for the soft palate

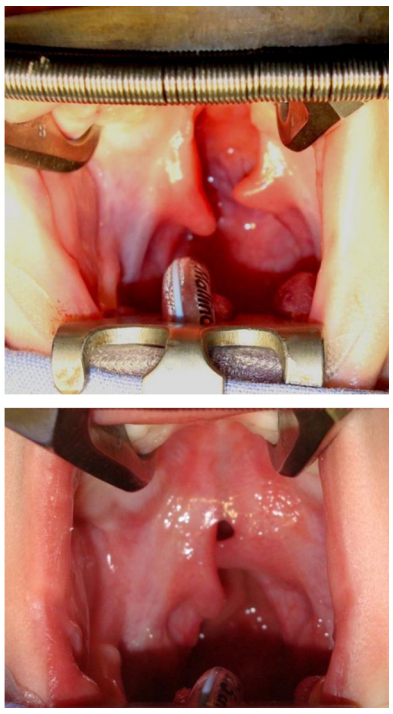

Fig. 1. The asymmetrical soft palate: (a) complete cleft and (b) partial submucosal cleft.

cleft based on its preoperative anatomical appearance, and the prelimin-ary results of the repair of the soft palate, including the position of the paired uvula. The aim of the study was to evaluate the perioperative outcomes in respect to sym-metry, uvula appearance, and oro-nasal fistula development, comparing the type II and newly introduced type III intravelar veloplasty techniques.

Materials and methods

Database

Data collected over the past 7 years in the facial cleft deformity clinic were analyzed for two separate periods. During the first period, from 2005 to 2008 (group 1), patients with clefts involving the soft palate had their clefts repaired by means of a type II intravelar veloplasty. During the second period, from 2008 to 2012 (group 2), similar patients underwent the type III intravelar veloplasty procedure. All patients born with a cleft lip, alveolus and palate (CLAP), a COMBI cleft, a hard palate and soft palate cleft (hPsP), and those with an isolated soft palate cleft (sP) (Table 1) were included in this research data.

Surgical technique

The surgical technique for the type III intravelar veloplasty, an advancement of the type II technique, consists of the crea-tion of a straight line dissection on the edge of the longer side of the cleft soft palate with inclusion of the uvula, whereas on the short side of the cleft soft palate, the straight line incision is stopped anteriorly (Fig. 2a) to the uvula, which will be pre-served and partially released by means of a perpendicular incision involving the oral and nasal mucosal layer (Fig. 2b). A tri-angular opening is affected on the nasal mucosal side, achieving a posterior rotation of this preserved uvula (Fig. 2c). Furthermore, the oral mucosal layer is released at the anterior region of the cleft or hard and soft palate junction, with a small oblique incision to release the oral layer posteriorly. After the surgical release of the levator muscle anteriorly at the palatal bone and medially adjacent to the medial pterygoid plate, the muscle is rotated posteriorly, on both sides. The palatoglossal–palatopharyngeal muscle bundles are released close and anteriorly to both uvulas and again rotated posteriorly (Fig. 2d). At this stage the tension-free nasal mucosa is sutured with the non-preserved dissected uvula rotated at 90°; this uvula's posterior point is sutured into the perpendicular nasal releasing incision on the opposite side (Fig. 2c).

The non-preserved uvula mucosa with its muscle (from the longer side of the cleft soft palate) is now covering the nasal mucosal triangular area at the shorter side of the cleft soft palate with the result that the preserved uvula (short side) with its adjacent tonsillar pillars is positioned more posteriorly. The palatoglossal–palatopharyngeal muscle bundles are approxi-mated and sutured by means of a double

Table 1. Soft palate clefts and various categories of asymmetrical cleft.

All types of clefts involving the soft palate	CLAP	COMBI	hPsP	sP	Total (with soft palate cleft)
Total clefts, $N = 3644$	1440	154	600	678	2872
Soft palate cleft repaired, 2005–2012	124	13	73	67	277
Asymmetrical soft palate cleft repaired, 2005–2012 (percentage of soft palate cleft)	12 (9.7%)	3 (23.1%)	20 (27.4%)	14 (20.9%)	49 (17.7%)

CLAP, cleft lip, alveolus and palate; COMBI, combination clefts; hPsP, hard palate and soft palate cleft; sP, isolated soft palate cleft.

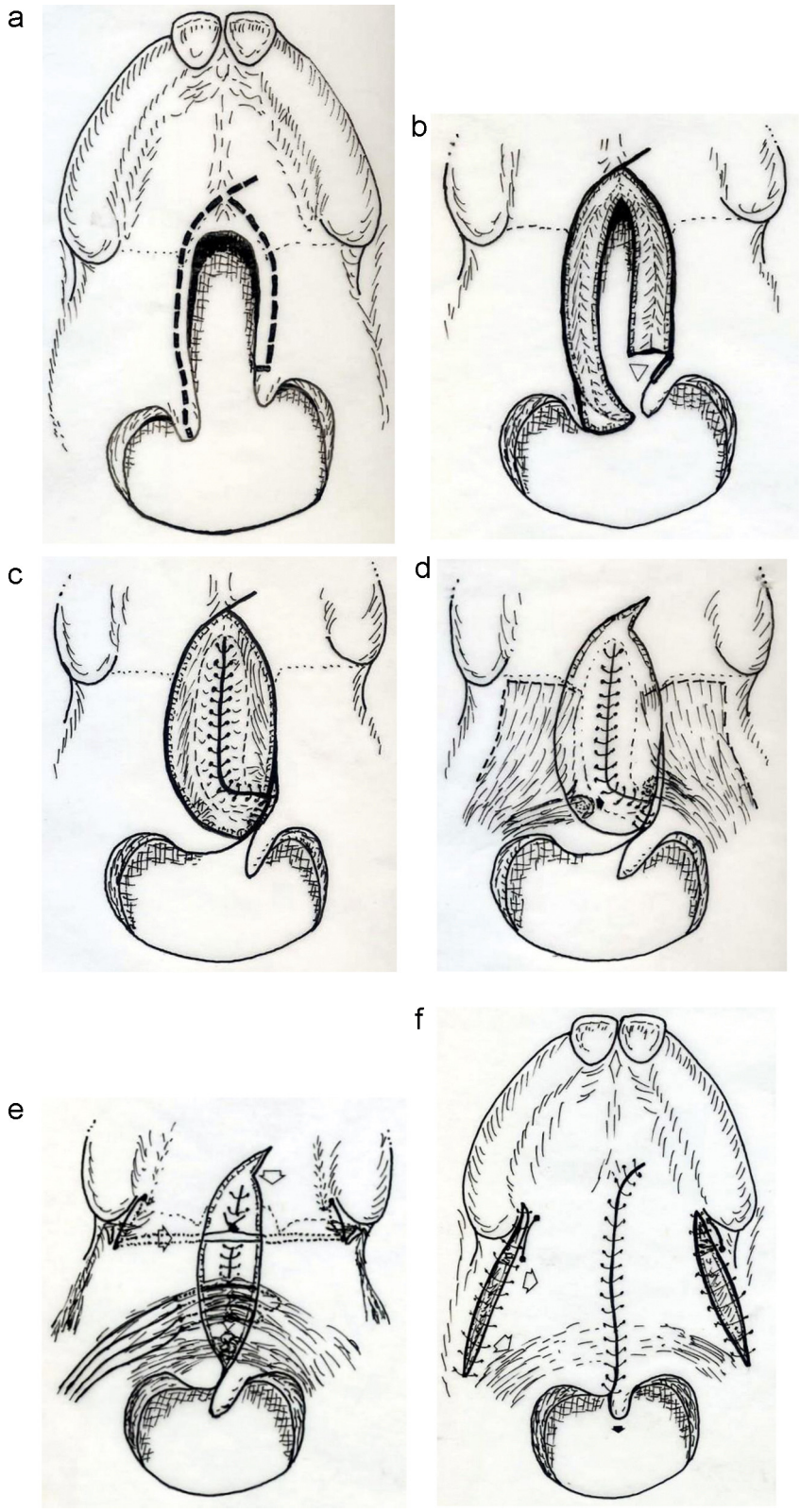

Fig. 2. Line illustrations: (a) incisional lines; (b) nasal mucosal dissection; (c) suturing of the nasal mucosa with lengthening of the short side; (d) dissection of the levator muscle and palatoglossal–palatopharyngeal muscle bundle; (e) tenopexy of the tensor veli palatini muscle, placement of the sutures for the levator muscle, release of the anterior oral mucosa; (f) lateral releasing incisions and suturing of the oral mucosa.

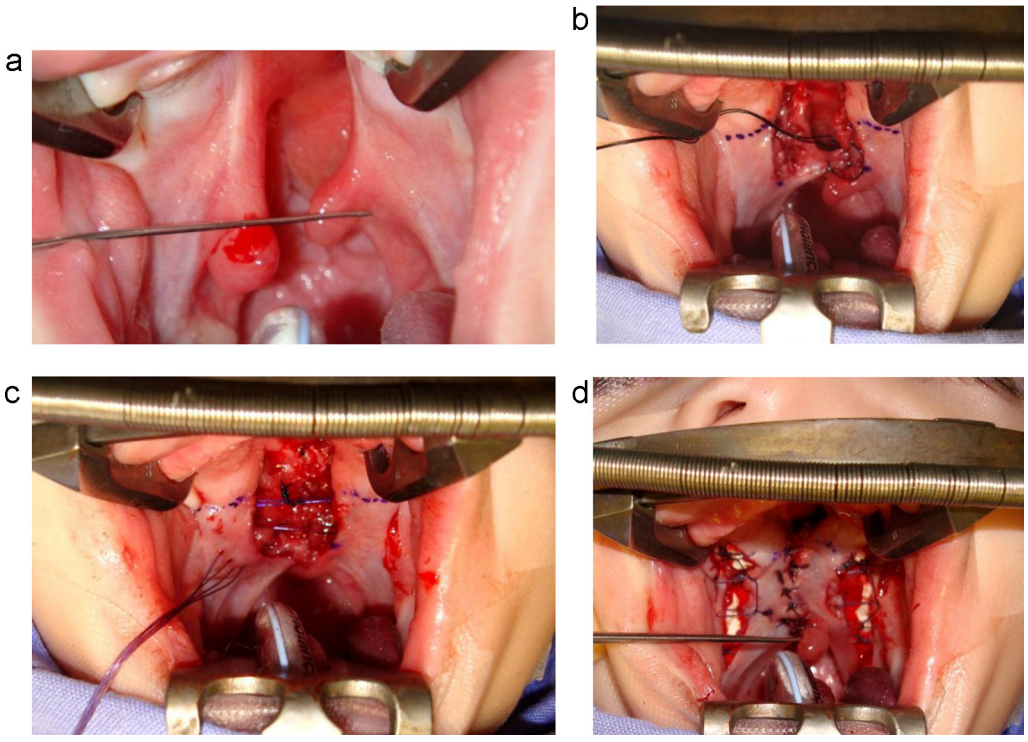

Fig. 3. Repair of the asymmetrical soft palate cleft (1): (a) preoperative asymmetrical appearance; (b) placement of the non-preserved uvula into the triangular opening on the nasal side (marks = border between hard and soft palate); (c) from top to bottom on the photograph: tenopexy for tensor veli palatini muscle, placement of levator muscle sutures after suturing of the palatoglossal–palatopharyngeal muscle bundle; (d) suturing of the oral mucosa after lateral releasing incision.

figure of eight suture. The preserved uvula is therefore centralized and rotated posteriorly. Since this preserved uvula is not dissected, it maintains its size in volume, length, and function. The levator muscles are rotated and aligned with vertical mattress sutures, with one posterior suture engaging the nasal mucosa, adjacent to the palatoglossal–palatopharyngeal sutured bundle, thereby avoiding a dead space between the muscle bundle and the nasal mucosa (Fig. 2e). These two levator muscle sutures (one anterior, one posterior) are knotted only after the lateral oral mucosa is released, as the levator muscle is further freed from the lateral part of the superior constrictor muscle so that it can be maximally rotated to facilitate zero tension at their interdigitation. A special long-term soluble material is used to stitch (tenopexy) and to activate the tensor muscle bundle, adjacent to the pterygoid hamulus, with the aim of maintaining patency of the Eustachian tube[11] in the long term (Fig. 2e). The bilateral lateral mucosa is now released and the lateral part of the superior constrictor and levator muscles are separated posteriorly and anteriorly to the tenopexy, without engaging the tendon of the tensor veli palatini muscle. On the long side of the cleft soft palate, the oral mucosal releasing incision is rotated slightly medially in the anterior region in order to position posteriorly the oral mucosal tissue for the short side cleft soft palate, only for the isolated soft cleft palate (sP)(Fig. 2e). Otherwise one has to create an anterior perpendicular oral releasing inci-sion for the CLAP and hPsP. Once the oral mucosa has been sutured at the cleft edge, the myopexy of the levator muscle is now completed, as the previously threaded through sutures are knotted. An absorbable haemostatic gelatin sponge is generally used to fill the gap at the releasing incisions and is kept in place by a loose uninterrupted reverse knotted suture (Fig. 2f).

Evaluation

The postoperative symmetry was evaluated by measuring the position of the reconstructed uvula in relation to the midline, as well as the relative distances of the uvula to the posterior margins of the maxillary tuberosities. The distance between the reconstructed posterior border of the soft palate and the posterior wall of the pharynx was measured and compared to the preoperative measurements. The uvula's appearance was visually judged to be lying centrally or rotated laterally or posteriorly. The development of an oro-nasal fistula at the junction of the hard palate and soft palate was evaluated postoperatively at the time of patient follow-up (generally at the 3-month follow-up), by means of inspection. The postoperative results were

Table 2. Soft palate cleft type II intravelar veloplasty versus type III intravelar veloplasty.

Repair of soft palate cleft	Total soft palate cleft	Asymmetrical total	Total type II	Asymmetrical type II	Total type III	Asymmetrical type III
	2005–2012		Group 1 2005–2008		Group 2 2008–2012	
Number	277	49	153	23	124	26
Percentage		17.7%	55.2%	15.0%	44.8%	21.0%

Table 3. Postoperative results of soft palate cleft type II intravelar veloplasty versus type III intravelar veloplasty.

Postoperative results	Asymmetrical type II (Group 1)	Asymmetrical type III (Group 2)
Remained asymmetrical	30.4%	3.8%
Oro-nasal fistulae occurrence	13.0%	3.8%
Uvula appearance (subjectively for length and atrophy)	47.8%	7.7%

compared between the two groups (Tables 2 and 3).

Speech outcomes following the use of the type III intravelar veloplasty have not been evaluated, as the patient population is still too young to accurately assess this. This will be evaluated at a later stage to draw the relevant conclusions.

Results

During the period 2005–2012, 277 soft palate clefts were repaired: 153 by means of a type II intravelar veloplasty and 124 by means of a type III modification. Of the 277 patients with soft palate clefts, 49 (17.7%) presented with an asymmetrical cleft. Twenty-three asymmetrical soft palate clefts were repaired using the type II procedure and 26 using the type III procedure (Table 2). Of the patients who underwent the type II procedure, 30.4% retained asymmetry as compared to 3.8% of those who underwent the type III procedure. The uvula appeared subjectively atrophic and often non-functional in 47.8% of the soft palates repaired by means of the type II procedure, but was only deemed atrophic in 7.7% of patients who underwent the type III procedure. Oro-nasal fistula occurred in 13.0% of the cases who underwent the type II procedure and in 3.8% of cases in the type III group (Table 3). The cases operated by means of the type III procedure presented with no or minimal asymmetry in the length of the soft palate.

The type III intravelar veloplasty technique achieves a well-balanced repaired soft palate (Figs. 3, 4 and 5).

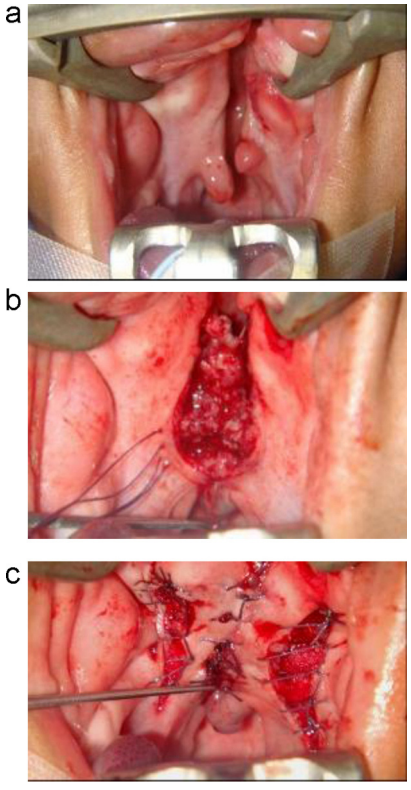

Fig. 4. Repair of the asymmetrical soft palate cleft (2): (a) preoperative asymmetrical appearance; (b) placement of levator muscle sutures after suturing of the palatoglossal–palatopharyngeal muscle bundle; (c) after oral mucosal layer suturing.

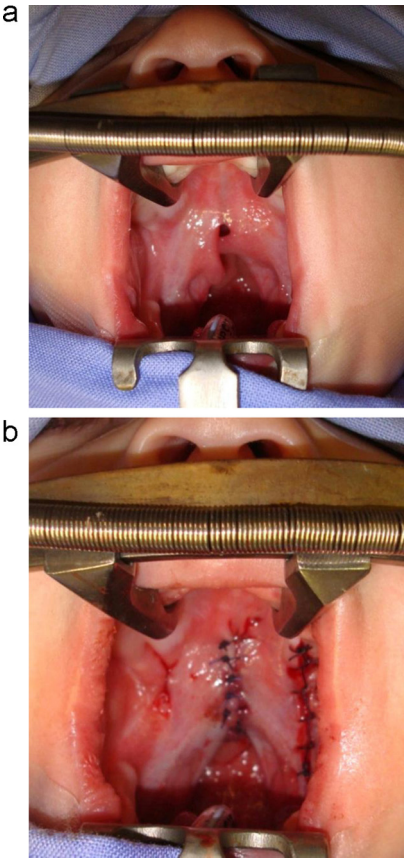

Fig. 5. Asymmetrical cleft: (a) preoperative appearance; (b) direct postoperative appearance.

Discussion

The asymmetrical soft palate cleft may be very obvious, in particular if one side is much shorter, resulting in a substantial soft tissue shortage on one side of the cleft, including its musculature structures. The uvula on the shorter side of the cleft soft palate is mostly normal in length and volume. It might, however, be rotated anteriorly, superiorly, or inferiorly. The repair of the asymmetrical soft palate cleft is challenging and requires a specialized surgical intervention.

The incidence, as well as the specific repair technique of the asymmetrical soft palate cleft, does not seem to be reported in the literature. This report highlights the incidence of asymmetrical clefts found in 277 consecutive surgical cases involving the soft palate, as well as the specific repair technique of the asymmetrical soft plate cleft. The short-term results with regard to the appearance and postoperative complications are extremely encouraging. The long-term results with regard to speech development remain to be assessed at around 4–5 years of age in these particular patients.

The incidence of asymmetrical soft palate cleft according to the database on which this publication is based is 17.7% of the total number of soft palate clefts (CLAP, COMBI, hPsP, and sP) repaired. Of 3644 patients born with a facial cleft seen at our facial cleft deformity clinic, 2872 patients (78.8%) presented with a soft palate cleft. Asymmetrical clefts were repaired in 9.7% of cases with CLAP, in 23.1% of the COMBI clefts (example cleft lip with soft palate cleft), in 27.4% of the hPsP, and also in 20.9% asymmetrical sP. The ratio of the repaired asymmetrical cleft to the symmetrical cleft of the soft palate is 1:4.7.

The type III intravelar veloplasty addresses this asymmetry: the balanced appearance in length with lengthening of the short side of the soft palate, its muscular alignment, the uvula length, volume, and position, as well as the reduced number of oral–nasal fistulae. On the one side of the soft palate (namely the shorter side), the uvula is preserved in its preoperative state and as it is, has not been operated upon; this uvula retains its size and structure (Fig. 6a).

In the type II intravelar veloplasty, a reconstructed paired uvula, with myo-

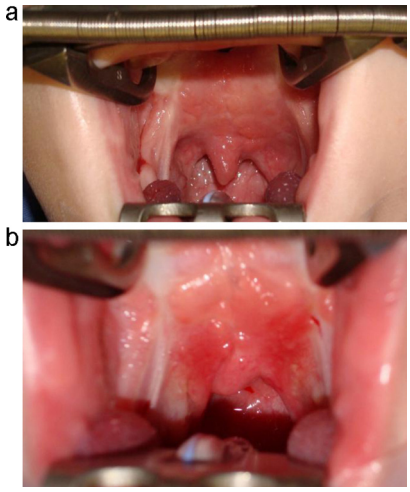

Fig. 6. Repaired asymmetrical soft palate: (a) normal uvula appearance with minimal asymmetry; (b) oblique uvula appearance.

pexy, appears much shorter and atrophic. In some cases of the type III intravelar veloplasty, the preserved uvula may be slightly obliquely situated (Fig. 6b). The dissected uvula from the longer side of the cleft is inserted into the nasal layer, immediately lengthening the shorter side of the cleft as well as creating a tension-free nasal mucosal layer.[10] In comparison to the type II intravelar veloplasty,[7] the levator muscles are more extensively released from the posterior palatal bone and later-ally from the oral and nasal mucosa adjacent to the pterygoid plate, and rotated more medially–posteriorly[9] before suturing. An important aspect is that the levator muscles are sutured only after the lateral oral mucosal releasing incisions have been made.

With this releasing incision the levator muscles have therefore been released from the lateral part of the superior constructor muscles and positioned further medially, thereby creating less tension at its central interdigitation. Additionally, the palatoglossal–palatopharyngeal muscle bundles are released adjacent and just anteriorly to each uvula. These bundles could sometimes, but very seldom, be separated into two individual muscles, the palatoglossus muscle and the palatopharyngeus muscle, and sutured separately. The slight curvature of the lateral releasing incision on the long side (COMBI and sP) or the small anterior perpendicular incision at the hard and soft palate junction (CLAP and hPsP), allow lengthening of the oral mucosa on the short side of the cleft.

The postoperative results of the asymmetrical soft palate clefts that were repaired by means of the type II intravelar veloplasty (2005–2008)[7] were compared to the postoperative results of the type III intravelar veloplasty (2008–2012). It is quite obvious that the results favour the type III intravelar veloplasty repair technique for the asymmetrical soft palate cleft, particularly in cases where the asymmetrical soft palate cleft is more severe.

The incidence of the asymmetrical soft palate cleft is 17.7% of all soft palate clefts. Surgery of these clefts has a more favourable outcome after a type III intravelar veloplasty repair. Tension-free closure with the creation of sufficient length on the short side of the cleft and the low risk of the formation of fistula combined with a very good appearance of the uvula are important initial advantages of this technique. Long-term results with regard to speech development need to be assessed at a later stage.

Funding

None.

Competing interests

None.

Ethical approval

Soft palate length measurement without patient identification was approved by the Faculty of Health Science, University of Pretoria.

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Address:
PO Box 345
Wapadrand 0050
South Africa
Tel: +27 12 8073065; Fax: +27 12 8073064
E-mail: kurt@butow.co.za