Journal of Cranio-Maxillo-Facial Surgery 45 (2017) 1–7

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Velopharyngeal insufficiency treated with levator muscle repositioning and unilateral myomucosal buccinator flap☆,☆☆

Robrecht J.H. Logjes [a, *], Maaike T.A. van den Aardweg [b], Meike M.J. Blezer [a], Anne M.B. van der Heul [c], Corstiaan C. Breugem [a]

[a] Division of Pediatric Plastic and Reconstructive Surgery, University Medical Centre Utrecht, Wilhelmina Children's Hospital, Utrecht, The Netherlands
[b] Division of Ear-Nose and Throat Surgery, University Medical Centre Utrecht, Wilhelmina Children's Hospital, Utrecht, The Netherlands
[c] Speech Pathology, Division of Pediatric Plastic and Reconstructive Surgery, Wilhelmina Children's Hospital, The Netherlands

ARTICLE INFO

Article history:
Paper received 2 June 2016
Accepted 21 October 2016
Available online 31 October 2016

Keywords:
Velopharyngeal surgery
Cleft surgery
Speech surgery
Buccal flap
Buccinator flap
Velopharyngeal insufficiency

ABSTRACT

Purpose: Velopharyngeal insufficiency (VPI) is common (20–30%) after cleft palate closure. The myomucosal buccinator flap has become an important treatment option for velopharyngeal insufficiency; however, published studies all use bilateral buccinator flaps. This study assesses outcomes with a unilateral myomucosal buccinator flap that might result in less operating time and might prevent the need of a bite block and an extra procedure for division of the flap pedicle at a later stage.
Materials and methods: Forty-two consecutive patients who underwent a unilateral myomucosal buccinator flap procedure were retrospectively reviewed. Overall clinical judgment of speech, speech analysis, and velopharyngeal closure were evaluated by a multidisciplinary cleft palate team.
Results: Median follow-up was 1.2 years. In 83% of patients, overall clinical judgment of optimal speech was obtained and thus no further velopharyngeal surgery was necessary. In 7 patients, further surgery was necessary, of whom 57% (4/7) had bilateral cleft lip–palate. Mean level of intelligibility improved significantly as evaluated by speech pathologists (2.5 ± 0.9 vs 3.5 ± 0.9; $P < 0.0001$) and by parents (2.1 ± 0.9 vs 3.2 ± 0.7; $P < 0.0001$). Mean level of resonance improved significantly (0.7 ± 0.9 vs 2.0 ± 1.0; $P < 0.0001$), and velopharyngeal closure improved in 83% postoperatively.
Conclusion: The unilateral myomucosal buccinator flap seems to be an effective and safe procedure and should become part of the armamentarium of cleft surgeons.

1. Introduction

In patients with velopharyngeal insufficiency (VPI), effectively separating airflow between the nasal and oral cavities during speech fails due to insufficient palate length and/or mobility. This insufficiency of the soft palate and the lateral/posterior pharyngeal walls leads to hypernasality, nasal air emission, and compensatory misarticulation, which decreases speech intelligibility (Sloan, 2000; Johns et al., 2003; Lam et al., 2007).

Unfortunately, 20–30% of the primary cleft palate closures still have velopharyngeal insufficiency, and secondary surgery is often imperative (Witt et al., 1998; Bicknell et al., 2002; Mahoney et al., 2013). Numerous treatments for VPI, both prosthetic appliances and surgical treatments, have been described. Treatment by using prosthetic appliances such as palatopharyngeal obturators, palatal lifts, or pharyngeal bulbs are nonoperative options (Tachimura et al., 2004; Pinto et al., 2007). However, most frequently either a posterior pharyngeal flap or a sphincter pharyngoplasty is used (Hynes, 1950; Trier, 1985; Rudnick and Sie, 2008). Snoring, mouth breathing, obstructive sleep apnea (OSA), hyponasal speech, nasal mucous flow disruption, disrupted maxillary outgrowth and even death are complications reported in the literature (Sphrintzen, 1998; Orr et al., 1987; Hill et al., 2004; Abyholm et al., 2005). A recent study from Madrid et al.,

☆ Presented at The European Craniofacial Congress in Gothenburg Sweden June 26, 2015.

☆☆ Presented at The Annual Meeting of The Dutch Association of Plastic Surgery in Eindhoven The Netherlands May 20, 2016.

* Corresponding author.
E-mail address: r.j.h.logjes@gmail.com (R.J.H. Logjes).

http://dx.doi.org/10.1016/j.jcms.2016.10.012
1010-5182/

Table 1
Oronasal sentences for children < 8 years of age to asses nasality by nasometry used in the Wilhelmina Children's Hospital (comparable to Zoo passage, excludes nasal consonants).

Miep is op school. [mip Is ɔp sɣol] (Miep is at school)
Nu gaat zij kleuren. [nu ɣat zɛi kløren] (Now she will color)
Zij tekent de juf. [zɛi ˈtekənt də jʏf] (She is drawing the teacher)
Dat wordt heel mooi. [dɑt wɔrt hel moj] (This is becoming very beautiful)
Juf geeft Miep stickers. [jʏf ɣeft mip stIkərs] (The teacher gives Miep stickers)

Table 3
Intelligibility score used by parents.

1	Speech is understandable and normal
2	Speech differs from other children. This does not lead to comments and speech is understandable
3	Speech differs from other children. This leads to comments, but speech is understandable
4	Speech is poorly understandable
5	Speech is not understandable

Table 4
Intelligibility score used by speech-language pathologist in the Wilhelmina Children's Hospital.

1	Always understandable for everybody without difficulty
2	Speech-disorder hearable, although understandable
3	Speech-disorder hearable, understandable with some difficulty
4	Speech-disorder hearable, understandable for family with some difficulty, however poorly understandable for strangers despite effort
5	Barely or not understandable for anyone despite effort

2015, demonstrated with polysomnography sleep studies that >80% of cleft patients with VPI treated with a dynamic pharyngoplasty presented with obstructive sleep apnea >1 year after pharyngeal surgery. Both the cranial based flap and the dynamic pharyngoplasty alter the anatomy of the lateral pharyngeal walls and posterior pharynx, whereas other, more recently described surgical techniques for VPI, such as the double opposing Z-palatoplasty (DOZ) or the use of the bilateral buccinators myomucosal flap, pay more respect to the original anatomy of the velum during reconstruction (Hill et al., 2004; Chim et al., 2015). Hill et al. (2004) published the first experience of using a bilateral myomucosal buccinator flap in 16 VPI-patients after primary cleft repair, resulting in normal resonance in 87% of the patients postoperatively.

Two recent studies demonstrated that use of the buccinator myomucosal flap is an important surgical treatment option for VPI (Hill et al., 2004; Mann et al., 2011; Hens et al., 2013). However, these published studies all use bilateral myomucosal buccinator flaps to lengthen the velum. A unilateral myomucosal buccinator flap procedure hypothetically results in less operating time for patients. The incorporation of an oral mucosa Z-plasty could impede the need for a bite block postoperatively to protect the buccal flap pedicle. More importantly, by using this new technique, an extra procedure to divide the flap pedicle at a later date could be prevented. Additionally, by reconstructing the velum with a unilateral myomucosal buccinator flap the other contralateral flap is still available as a possible salvage option. Robertson et al. (2008) described the use of a unilateral myomucosal buccinator flap for the first time in secondary repairs of 20 cleft patients with velopharyngeal insufficiency, oronasal fistulas, or both. The small patient group, mixed indication for surgical treatment (only seven patients had VPI), and the fact that 50% of the patients were treated with additional palatoplasties before the postoperative analysis for their study, may lead one to question the effectiveness of this procedure (Robertson et al., 2008).

In this study, the effect of levator muscle repositioning and an oral Z-plasty in combination with a unilateral myomucosal buccinator flap for treatment of secondary velopharyngeal insufficiency was investigated in a group of consecutive cleft patients.

2. Materials and methods

2.1. Patients and procedures

We retrospectively reviewed 42 consecutive patients who presented with symptoms of secondary velopharyngeal insufficiency in the Wilhelmina Children's Hospital (2012–2014) who underwent a palatal Z-plasty with unilateral myomucosal buccinator flap procedure performed by the senior author. All patients who presented with velopharyngeal insufficiency after cleft palate surgery were included, and no specific exclusion criteria were applied, specifically no exclusion of syndromic patients. In all patients, the primary palatoplasty was performed by the modified Von Langenbeck technique.

The multidisciplinary cleft palate team in the Wilhelmina Children's hospital who participated in this study consists of three certified speech pathologists, an ENT surgeon, and a plastic surgeon. Optimal overall clinical judgment of speech was achieved when postoperatively speech improved such that no secondary surgery was needed. Speech analysis was performed by evaluating the level of intelligibility and the resonance to assess hypernasality, which is the result of air escaping through the nasopharynx mainly when patients use vowels. The nasality was graded on a scale ranging from 0 (normal nasality) to 3 (severe hypernasality) by the speech pathologists. With the use of nasometry, a computer-based method to measure the ratio between the oral air escape and the nasal air escape during speech, the objective level of hypernasality was assessed. The Nasometer, Kay Pentax Model 6450, converts these measures to a percentage value for the nasalance score. The sentences produced by the child are displayed in Tables 1 and 2. These sentences contain both oral and nasal sounds, representing

Table 2
Oronasal sentences for children ≥8 years of age to assess nasality by nasometry used in the Wilhelmina Children's Hospital (11.67% of nasal consonants, corresponding to the English Rainbow passage (11.5%)).

Papa en Marloes staan op het station. [ˈpapa ɛn Mɑrlus stan ɔp hət stɑʃɔn] (Daddy and Marloes are at the trainstation)
Ze wachten op de trein. [Zə wɑXtən ɔp də trɛin] (They are waiting for the train)
Eerst hebben ze een kaartje gekocht. [erst hɛbən zə en kartjə ɣəkɔʏt] (First they bought a ticket)
Er stond een hele lange rij, dus dat duurde wel even. [ər stɔnt ən helə lɑŋə rɛi] (there was a long queue, so it took a while)
Nu wachten ze tot de trein eraan komt. [ny ˈwɑXtən zə tɔt də trɛin ˈəran kɔmt] (Now they are waiting for the train to come)
Het is al vijf over drie, dus het duurt nog vier minuten. [Hət Is ɑl vɛif ˈovər dri, dʏs hət dyrt nɔɣ vir minytən] (It is five past three, so it will take 4 more minutes)
Er staan nog veel meer mensen te wachten. [ər stan nɔg vel mɛnsən tə wɑXtən] (there are more people waiting)
Marloes kijkt naar links, in de verte ziet ze de trein al aankomen. [ˈMɑrlus kɛikt nar lIŋks, In də ˈvɛrtə zit zə də trɛin ɑl ˈankomən] (Marloes looks to the left, she sees the train coming in the distance)