Autologous Fat Grafting for the Treatment of Mild to Moderate Velopharyngeal Insufficiency

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Background: To assess speech results following the treatment of mild to moderate velopharyngeal insufficiency (VPI) post cleft palate surgery with autologous fat grafting to the velopharynx.

Methods: A retrospective study was conducted on 9 consecutive patients who underwent velopharyngeal fat grafting for the treatment of VPI at the Red Cross War Memorial Children's hospital from 2010 to 2014. All the patients previously had primary palatoplasty performed and subsequently developed VPI. Patients were assessed pre- and postoperatively by an experienced speech and language therapist looking at perceptual speech and by 2 senior cleft surgeons interpreting lateral view videofluoroscopies.

Results: Eleven fat grafting procedures were performed on 9 patients and an average of 5.64 mL (range 1–7 mL) of autologous fat was transferred to the velopharynx. The average age at the time of operation was 6.5 years (range 3–14 years) with a follow-up period of 18 months (range 7–34 months). Most of the patients (7 out of 9) showed improved speech after fat grafting. One of the 7 patients had multiple procedures. The 2 who did not show speech improvement only had a single procedure. There were no complications related to the fat grafting procedure.

Conclusion: This small study suggests that fat grafting either as a single procedure or as multiple procedures is an effective, safe, minimally invasive surgical alternative, and/or adjunct for the treatment of mild to moderate VPI in patients following cleft palate surgery and to the knowledge, is the first reported study from Africa.

Key Words: Fat grafting, lateral videofluoroscopy, perceptual speech assessment, velopharyngeal insufficiency

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Velopharyngeal insufficiency (VPI) is the inability to close the velopharyngeal sphincter and separate the oral cavity from the nasal cavity during the production of speech and deglutition.[1,2]

The normal upward and backward movement of the velum, and the simultaneous mesial movement of the lateral pharyngeal walls and the anterior movement of the posterior pharyngeal wall separate the oral cavity from the nasal cavity during speech and deglutition.[1] When the normal space and functional relationship between the velum and the pharynx are lost, the sphincter mechanism is lost and this results in velopharyngeal incompetence.[3] The increased nasal airflow as a result of VPI is characterized by hypernasality, nasal emission, and compensatory changes such as glottal stops, particularly during the production of plosive and sibilant consonants. It can affect the intelligibility of speech depending on the severity of the insufficiency.[4–6] Patients with velopharyngeal incompetence often develop articulation errors in an attempt to compensate for the inability to close the velopharyngeal port. These include glottal stops, pharyngeal stops, pharyngeal fricatives, palatal stops, and velar fricatives.[7]

Velopharyngeal dysfunction is a general term with multiple subtitles and descriptions defining any abnormal function of the velopharyngeal sphincter irrespective of the cause.[2,8–10] For the purpose of this study, VPI is used as a single generic term denoting any insufficient tissue or mechanical restriction of the velopharynx.

Dejonckere and van Wijngaarden were among the first authors who reported on fat grafting of the posterior pharyngeal wall.[11] Despite its numerous advantages and the predictable use of fat grafting as a treatment modality for soft-tissue augmentation,[12–14] there is a paucity of data on the outcome of speech following autologous fat grafting of the velopharyngeal structures for the treatment of VPI.[15,16] The reduced risk of complications compared to more invasive surgery makes it an attractive alternative treatment modality for mild to moderate grades of VPI. This study documents our results of autologous fat grafting of the velopharynx for mild to moderate VPI in 9 children over a 4-year period.

METHODS

This study included all the patients who underwent fat grafting for the treatment of mild to moderate VPI from February 2010 to January 2014 at the Red Cross War Memorial Children's Hospital. The patients previously underwent cleft palate surgery at the same unit.

Those patients who presented to the cleft clinic with VPI were assessed by a cleft surgeon and a speech and language therapist. A lateral view videofluoroscopy was performed on all the patients to confirm the clinical diagnosis of VPI and to obtain more information on the velopharyngeal valve closure, excursion of the velum and posterior pharynx, point of knuckling of the velum, level of contact or closure between the pharynx and velum and the amount of apposition between the velum and posterior pharynx. The videofluoroscopy findings were interpreted by 2 senior cleft surgeons and patients were selected using a lateral view videofluoroscopy (VF)-based classification system (Supplemental Digital Content, Table 1, http://links.lww.com/SCS/B18)[17–19] Patients with

class II to class IV are eligible for fat grafting (single/multiple procedures) and patients with class V are treated with standard pharyngoplasty techniques (Supplemental Digital Content, Table 1, http://links.lww.com/SCS/B18). An experienced speech and language therapist performed the perceptual assessment of speech intelligibility, hypernasality/hyponasality, and nasal air escape. Hypernasality was graded as mild, moderate, or severe.

Patients with mild (class III) to moderate (class IV) VPI were treated with fat grafting of the velopharynx. A single surgeon performed the surgery. The fat was harvested from the anterior abdominal wall and a modified Coleman technique (centrifugation at 2000 rpm for 1 minute) was used to process the fat. The fat was transferred to the posterior pharyngeal wall via a stab incision made with a number 15 blade below the adenoid pad. The fat was deposited as high and as close as possible to the contact point, behind the upper part of the adenoid pad. It is transferred in parallel lines radiating upwards from the incision until a satisfactory level of augmentation is reached with no fat herniating or being lost from the incision site. This seldom exceeds 3 mL of fat transfer to the posterior pharynx.[20] A homemade modified J-shaped cannula (Fig. 1B) is used to transfer the fat to the posterior pharynx as the use of a standard straight cannula is technically challenging. A vertical incision is used to allow easy closure with a single 5'0 vicryl suture to prevent fat graft loss through the incision. Fat transfer to the palate is performed with a blunt tip cannula from the oral aspect onto the nasal aspect posteriorly over the anticipated contact area at approximately a 1:1 ratio with the posterior pharynx. There were no complications and all the patients were discharged 1 day after the procedure.

The outcomes were assessed clinically and with lateral view video-fluoroscopy by 2 cleft surgeons. A speech and language therapist performed the perceptual speech assessments. The pre- and postoperative findings were compared and changes in speech characteristics including intelligibility, hypernasality, hyponasality, and nasal emission as well as changes in videofluoroscopy were noted. The average follow-up period was 18 months with a range of 6 to 34 months.

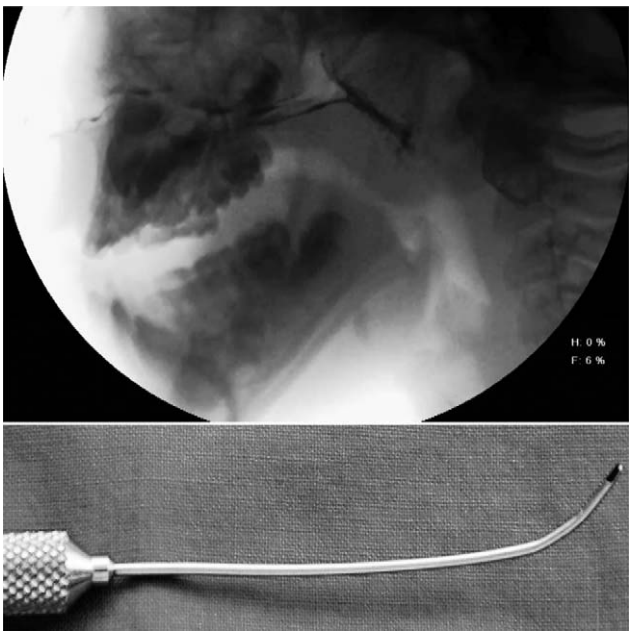

FIGURE 1. (A) Class I velopharyngeal insufficiency closure on lateral videofluoroscopy. Post single fat grafting procedure, at 36 months follow-up. (B) Modified homemade J-shaped cannula.

The descriptive data of the study population are presented in Supplemental Digital Content, Table 2, http://links.lww.com/SCS/B18. The average age at the time of fat grafting was 6.5 years (range of 3–14 years) and there were 6 girls and 3 boys with a primary diagnosis of a cleft palate.

The primary treatment of the cleft palate was either with a Furlow Z-plasty or an intravelar veloplasty.

RESULTS

The average volume of fat transferred was 5.64 mL (range 1–7 mL) and all except one of the patients (number 6) underwent 1 fat grafting procedure. The majority of the patients (7 out of 9 patients) improved both on perceptual speech assessment (degree of hypernasality) and velopharyngeal function as assessed on lateral view videofluoroscopy.

The outcome of VPI following fat grafting is presented in Supplemental Digital Content, Table 3, http://links.lww.com/SCS/B18. Six patients had class III (mild) VPI before undergoing fat grafting. Four of these patients improved to class II after 1 fat grafting procedure, and 2 patients (numbers 1 and 2) did not improve. Three patients had class IV (moderate) VPI before fat grafting, 2 of the patients improved to class III (mild) and 1 patient (number 4) had near normal speech (class I, Fig. 1A) after only 1 fat grafting procedure. One patient with class IV VPI (number 6) did not improve after 1 fat graft procedure, but subsequently improved to class III after 2 additional fat grafting procedures.

DISCUSSION

The traditional treatment of VPI of a structural cause is surgical and includes a Furlow Z-plasty, if not previously performed,[18] posterior pharyngeal flap or sphincter pharyngoplasty. Pharyngeal wall augmentation with various synthetic and autologous materials is an alternative to the traditional techniques, and prostheses are reserved for patients not suited for surgery.[2,4,5] Speech therapy also forms an integral part of the management of VPI.

Apart from perceptual speech assessment, the modalities used to assess VPI include videofluoroscopy,[21] nasopharyngeal endoscopy,[22,23] computerized tomography,[24] and magnetic resonance imaging.[25–27] Pigott and Makepeace[28] consider the use of nasal endoscopy and videofluoroscopy indispensable and complementary providing both qualitative and quantitative information, respectively. On the contrary, Cohn et al[29] and Birch et al[21] consider the use of lateral view videofluoroscopy with and without barium adequate and reliable. They report that it provides adequate information of the velum, pharynx, and any concurrent abnormalities. Videofluoroscopy is cost effective, minimally invasive, and does not require sedation.[30] It is our preferred method for the assessment of dynamic velopharyngeal function. In this study, the perceptual assessment of speech (hypernasality) correlated with the videofluoroscopy grading of VPI both before and after fat transfer to the velopharynx.

Overall, both speech resonance (hypernasality) and VPI grading on videofluoroscopy improved in 80% (7 out of 9 patients) of the patients. The majority of these patients (6 out of 9 patients) improved with only 1 fat grafting procedure and only 1 patient improved after 2 additional fat grafting procedures.

The outcome of fat grafting to the velopharynx for the treatment of VPI is variable in the present study which concurs with other studies. Two patients with mild VPI (class III) showed no improvement following a single fat grafting procedure, but 6 out of 9 patients had a positive outcome. There was no correlation between the volume of fat transferred and the degree of VPI. The volume of fat graft take is unpredictable[14,31] and this could explain the variable outcome in this study. Gir et al[31] clearly state in their 2012 review

that a major concern is the lack of reliability and consistency of the final clinical results, which often creates the need for multiple fat grafting procedures.

The positive outcome of fat grafting for VPI can be explained by the improved excursion of the velopharyngeal structures due to improved tissue pliability of previously scarred and tethered tissue, in addition to volume replacement.[13]

There was no correlation between the total volume of fat transferred and the outcome of speech resonance (hypernasality) or videofluoroscopic changes. In contrast, Filip et al reported a correlation of total volume of fat injected with the improvement in hypernasality.[27]

Obstructive sleep apnoea (OSA) is one of the most common complications following pharyngeal flap surgery for VPI with an incidence of 35%.[32] Autologous fat grafting to the velopharynx, although a less invasive procedure, does not completely eliminate the risk of OSA,[33] but it did not occur in this study.

The advantages and benefits of autologous fat grafting are numerous. The risk of complications is less and the procedure is technically less challenging compared to the traditional surgical techniques used for the treatment of VPI. There were no complications in the present study and similarly, other studies report very few complications following autologous fat grafting for the treatment of VPI.[15,16] All the patients in the present study were discharged 1 day after the procedure. The simplicity of the technique, shorter hospital stay, quicker recovery time, and less invasive nature of the technique makes it attractive to us as a treatment modality for mild to moderate VPI.

There is a paucity of literature on autologous fat grafting of the velopharynx for the treatment of VPI. Bishop et al[15] in their review article subsequently supported by Nigh et al[16] underscored the need for randomized control trials to reach consensus on the patient selection criteria for AFG as treatment for mild to moderate VPI, sites of injection, volume of fat for injection, standardized speech assessment scales, and instrumental assessment scales. The assessment modalities used and hence the definitions of mild and moderate VPI vary.[20,33–38] Nasoendoscopy and VF are the commonly used modalities to assess the degree of VPI. A nasopharyngoscopy based 5-point scale to grade and accordingly treat VPI has been reported.[39,40] A lateral view VF-based classification is used at our unit to grade patients with VPI,[17–19] and the appropriate treatment is selected depending on the degree of the VPI (Supplemental Digital Content, Table 1, http://links.lww.com/SCS/B18). A similar approach to AFG of the velopharynx for the treatment of mild to moderate VPI has not been reported in other studies.[15,16,20,33–38] Our results were obtained by injecting fat submucosally into the velum without perforation and as high as possible into the posterior pharyngeal wall where the velum is expected to make contact with the posterior pharyngeal wall. We elected not to inject fat into the lateral pharyngeal walls to avoid inadvertent intravascular injection. On the contrary, other authors have reported intramuscular injection into the superior constrictors and into the lateral pharyngeal walls with no complications.[39,40]

CONCLUSION

Autologous fat grafting of the velopharynx is an attractive, low risk, albeit unpredictable alternative for the treatment of patients with mild to moderate VPI when compared to traditional surgical techniques. This study reports on the first results of autologous fat grafting for the treatment of mild to moderate VPI following cleft palate surgery at our unit. We introduce an original lateral view VF-based classification to select patients and their subsequent treatment. As far as we know, it is the first reported study of autologous fat grafting for the treatment of mild to moderate VPI from Africa.

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