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CASE REPORT
Craniofacial

Application of Indocyanine Green Angiography for Perfusion Assessment of Buccal Myomucosal Flaps

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Summary: The indications for buccal myomucosal flaps (BMMFs) include velopharyngeal insufficiency (VPI) and palatal fistula. A major complication related to BMMF is partial flap necrosis due to its random blood supply. Indocyanine green (ICG) angiography is a proven technology to assess tissue perfusion, but there is limited report of its application to intraoral flaps, especially in cleft surgery. Two patients underwent BMMF for repair of palatal fistula and treatment of VPI. ICG angiography was performed to assess flap perfusion after flap elevation and again after flap inset. Patients were followed up for flap healing and speech assessments. In the first patient, ICG angiography confirmed excellent perfusion to both flaps after elevation and inset. In contrast, after elevation of bilateral BMMF in the second patient, ICG angiography identified excellent perfusion of the left BMMF but poor perfusion of the right BMMF. Debridement of the right flap was performed, and palatal reconstruction was completed with unilateral BMMF. Both patients healed uneventfully and had improvement in their hypernasality. In summary, ICG angiography can be a useful adjunct to assess the perfusion of BMMF during palatal reconstruction for VPI and/or palatal fistula. This intraoperative assessment may help to guide surgical decision-making with the aim of potentially reducing rates of flap necrosis and palatal fistula. *(Plast Reconstr Surg Glob Open 2025;13:e6636; doi: 10.1097/GOX.0000000000006636; Published online 14 March 2025.)*

The buccal myomucosal flap (BMMF) is a versatile reconstructive option for patients with cleft palate and is increasingly being incorporated into treatment algorithms of velopharyngeal insufficiency (VPI), palatal fistula, and some cases of primary palatoplasty.[1–3] Posteriorly based flaps supplied by branches of the facial and buccal arteries are commonly used in palatal reconstruction.[4] The advantages of BMMF include well-vascularized local tissue, minimal donor site morbidity, improved speech outcomes, and potentially reduced risk of upper airway obstruction compared with pharyngeal options.[5] However, partial or complete flap necrosis can be associated with up to 6% of cases, leading to the development of palatal fistula, poor speech outcomes, and the need for additional surgery.[6,7]

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Indocyanine green (ICG) angiography is a well-established technology for assessment of tissue perfusion in various surgical contexts. It involves intravenous ICG dye administration which fluoresces under near-infrared light and allows real-time visualization of blood flow in the target tissue. Although multiple studies have demonstrated the utility of ICG angiography in breast reconstruction and gastrointestinal surgery,[8] its application to intraoral flaps, particularly in the context of cleft care, remains underexplored. We hypothesize that ICG angiography can be easily applied to palatal reconstruction with BMMF and serve as a valuable adjunct to provide immediate feedback on flap perfusion intraoperatively. This information may help guide surgical decision-making, aiming toward a reduction in the incidence of postoperative flap necrosis and its associated sequelae.

CLINICAL REPORT

Case 1

The first patient was a 6-year-old boy with a history of 22q11.2 deletion syndrome, submucous cleft palate, and

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

Fig. 1. Intraoperative ICG angiography image of patient 1 after flap elevation showing similar fluorescence intensity in the elevated buccal myomucosal flap compared with surrounding tissue.

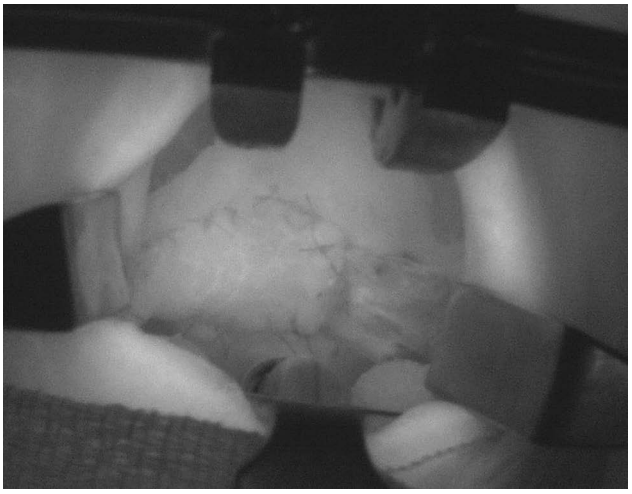

Fig. 2. Repeat ICG angiography image of patient 1 after completion of flap inset showing similar fluorescence intensity of the oral sided flap compared with surrounding tissue.

VPI. He had a history of Furlow palatoplasty which was complicated by development of a fistula near the hard and soft palate junction and persistent VPI. Perceptual speech evaluation revealed a Pittsburgh Weighted Speech Score of 5. Nasopharyngoscopy confirmed persistent central gap.

The patient underwent palatal lengthening and fistula repair with bilateral BMMF. Intraoperatively, a transverse incision was made through the soft palate across the fistula site, followed by elevation of bilateral BMMF. One tenth mg/kg of ICG dye was administered at a concentration of 0.5 mg/mL intravenously based on manufacturer's recommendations. A handheld SPY fluorescence imaging platform was used with the flaps in situ. This confirmed excellent perfusion of both flaps comparable to surrounding tissue based on ICG intensity (Fig. 1). Flap inset was then performed with 1 flap reconstructing the nasal aspect and the other flap on the oral side. Repeat perfusion assessment was performed with another dose of ICG dye confirming excellent perfusion of the oral flap with the flap inset completed (Fig. 2). The surgical site healed uneventfully with resolution of the fistula and noticeable speech improvement during his most recent follow-up visit at 5 months after surgery.

Case 2

The second patient was a 7-year-old boy with a history of submucous cleft palate and VPI after adenoidectomy. He had a history of Furlow palatoplasty and outpatient speech therapy with partial improvement of his hypernasal speech. However, he had persistent VPI with a Pittsburgh Weighted Speech Score of 6, and palatal lengthening with BMMF was recommended. Intraoperatively, bilateral BMMFs were elevated, and ICG angiography was then performed to assess flap perfusion. (**See figure, Supplemental digital content 1**, which displays intraoperative clinical image of patient 2 after elevation of right buccal myomucosal flap, **http://links.lww.com/PRSGO/D932**.) (**See figure, Supplemental digital content 2**, which displays intraoperative clinical image of patient 2 after elevation of left buccal myomucosal flap, **http://links.lww.com/PRSGO/D933**.)

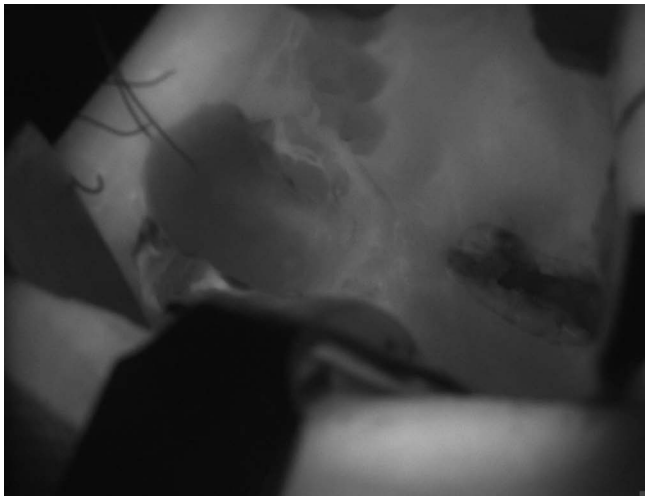

Fig. 3. Intraoperative ICG angiography image of patient 2 after elevation of right buccal myomucosal flap showing reduced fluorescence intensity of the flap compared with surrounding tissue.

The right-sided flap was found to have poor perfusion as evidenced by decreased fluorescence signal of the distal portion compared with surrounding tissue (Fig. 3) and robust fluorescence signal in the contralateral flap (Fig. 4). Therefore, the decision was made to perform debridement of the right-sided flap, and palatal reconstruction was completed with the left-sided BMMF only. The palatal reconstruction healed without any issues, and the patient had noticeable improvement in his hypernasality during his most recent visit at 4 months after surgery.

DISCUSSION

These 2 cases demonstrated the potential utility of ICG angiography as an adjunctive tool for perfusion

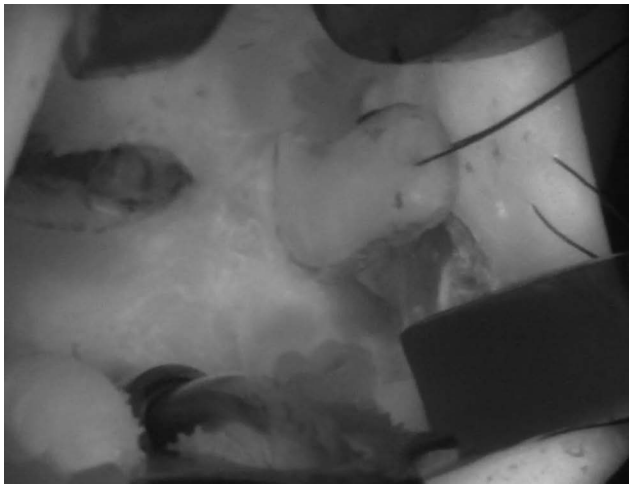

Fig. 4. In contrast, an ICG angiography image of patient 2 taken at the same time shows strong fluorescence and similar intensity as surrounding tissue of the left buccal myomucosal flap.

assessment of BMMF during palatal reconstruction. ICG angiography offered real-time visualization of tissue perfusion, which can guide intraoperative decision-making. In the first case, ICG angiography confirmed excellent blood flow of bilateral BMMFs at 2 important time points: after flap elevation and after inset. The perfusion information provided by ICG angiography helped to confirm the clinical assessment of flap perfusion and improve confidence in postsurgical healing. The second case highlighted the value of ICG angiography in detecting compromised flap perfusion. This finding prompted a modification in the surgical plan and may have avoided postoperative complications, including partial flap necrosis and possible palatal fistula.

Intraoperative ICG angiography is used by reconstructive surgeons for a variety of applications, including free flap reconstruction, and has been shown to significantly reduce the rate of fat necrosis after deep inferior epigastric perforator flaps for breast reconstruction and partial flap necrosis after free fibula flaps for head and neck reconstruction.[8–10] However, there are no known reports of its application in palatal reconstruction in children with cleft palate or VPI. One concern is the feasibility of using this technology in a small oral cavity. In our experience, handheld ICG devices such as the SPY Portable Handheld Imager (Stryker, Kalamazoo MI) is easy to use and can produce high-quality fluorescence images. Furthermore, avoiding tension during flap inset for pedicled flaps such as BMMF is essential to minimize risk of compromising perfusion. ICG imaging can be repeated after 20 minutes when the dye has been cleared from the tissue of interest, allowing repeat perfusion assessment after flap inset. This entire process adds only a few minutes to the operation and can provide valuable clinical information.

In conclusion, ICG angiography shows promise as a beneficial adjunct in the intraoperative assessment of BMMF perfusion during palatal reconstruction. These 2 cases demonstrated the feasibility of using the handheld SPY device for intraoral flap evaluation in pediatric patients and provide an example workflow for incorporating this technology in palatal lengthening surgery with BMMF. A similar workflow can be applied in other cleft and craniofacial surgery applications where random or axial patterned flaps may be performed for intraoral reconstruction. This study serves as a proof of concept, and future studies with more subjects are needed to optimize the workflow and evaluate the impact on postoperative outcomes, including rates of flap necrosis, palatal fistula, and speech outcomes.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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