



Original Article

The Bi-paddle Pectoralis Major Myocutaneous Flap in Oral Cancer Reconstruction: A Comprehensive Review of Literature

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ABSTRACT

The bipaddled pectoralis major myocutaneous (PMMC) flap represents a significant modification of the original pectoralis major flap described by Ariyan in 1979. This review analyses data from 11 published studies spanning 1989 to 2021, encompassing over 1,000 patients who underwent bi-paddled/bilobed PMMC flap reconstruction for complex oral cavity defects following cancer ablation. The flap provides simultaneous intraoral lining and external skin cover in a single-stage procedure, with the optional inclusion of a vascularized rib bone graft for mandibular reconstruction. Reported total flap loss rates range from 0% to 6%, with partial flap necrosis occurring in 0% to 20.8% of cases. Overall complication rates vary from 13% to 63%, with wound dehiscence, orocutaneous fistula, and surgical site infection being the most common adverse events. Technical modifications described include horizontal versus vertical paddle orientation, inclusion or preservation of the nipple-areola complex, paramedian approaches in females, and various pedicle lengthening techniques. While free tissue transfer remains the gold standard, the bipaddled PMMC flap continues to serve as a reliable, versatile, and cost-effective reconstructive option—particularly in resource-limited settings and as a salvage procedure.

Keywords: Bipaddle pectoralis major myocutaneous flap, bilobed PMMC flap, oral cancer reconstruction, through-and-through defect, head and neck reconstruction.

INTRODUCTION

Oral cavity cancer remains a major public health problem in the Indian subcontinent and other developing nations, accounting for nearly 30% of all malignancies in India.^{1,2} Patients frequently present with locally advanced disease (Stage III/IV) due to delayed diagnosis, limited healthcare access, and prevalent risk factors such as tobacco chewing, smoking, and alcohol consumption.^{3,4} The gingivobuccal complex, including buccal mucosa, lower alveolus, and retromolar trigone, is the most commonly affected subsite in the oral cavity, particularly in South Asia, where the habit of placing betel/tobacco quid in the buccal sulcus is widespread.⁵

Resection of such advanced tumours often results in full-thickness (through-and-through) composite defects involving mucosa, underlying soft tissue, bone (mandible or maxilla), and overlying facial skin.⁶ These defects present formidable reconstructive challenges: the surgeon must restore intraoral lining, provide external skin cover, re-establish oral competence, preserve speech and swallowing functions, and achieve acceptable cosmesis, all while minimising morbidity and avoiding delays in adjuvant therapy.^{7,8}

The pectoralis major myocutaneous flap, introduced by Ariyan in 1979, revolutionised head and neck reconstruction.⁹ Its advantages included reliable axial blood supply from the thoracoacromial artery, adequate bulk, excellent reach to the oral cavity and midface, proximity to the head and neck region, and relative technical simplicity.^{10,11} However, the original design provided only a single skin paddle, necessitating a second flap (typically the deltopectoral flap) for external cover in through-and-through defects, a two-stage or dual-flap approach with increased morbidity, longer hospital stays, and higher costs.^{12,13}

The bipaddled (synonymously used in various studies with “bilobed, folded, double-paddle, or gemini”) modification evolved from the need to simplify closure of full-thickness defects. By dividing or folding a single PMMC flap into two skin islands, one for mucosal lining and one for cutaneous cover, surgeons could achieve single-stage reconstruction of complex composite defects.^{14,15} Subsequent refinements included incorporation of a vascularized rib (osteomyocutaneous flap) for mandibular arch reconstruction and various technical modifications to enhance reliability, especially in female patients and for large defects.^{16,17}

This comprehensive review critically evaluates the published evidence on bipaddled PMMC flap reconstruction for oral cancer defects, analyzing outcomes, complications, technical innovations, and the flap's current role in the era of microvascular free tissue transfer.

METHODS

1. Literature Search Strategy

A systematic search of the PubMed/MEDLINE, Scopus, and Google Scholar databases was conducted using the following search terms and their combinations: "bipaddled pectoralis major flap," "bilobed pectoralis major flap," "folded pectoralis major flap," "double paddle pectoralis major," "PMMC flap oral reconstruction," "through-and-through defect cheek reconstruction," and "pectoralis major myocutaneous flap oral cancer." The search was limited to English-language articles published between 1980 and December 2021.

2. Inclusion and Exclusion Criteria

Studies were included if they: (1) reported original data on bipaddled/bilobed/folded PMMC flap reconstruction for oral cavity or oromandibular defects; (2) provided explicit outcome data including flap survival and complications; (3) included ≥ 10 patients; and (4) were published in peer-reviewed journals. Case reports, technical notes without outcome data, reviews without primary data, and studies of single-paddle PMMC flaps were excluded.

3. Data Extraction and Analysis

From each eligible study, the following data were extracted: study period, sample size, patient demographics, primary tumor site, defect characteristics, flap dimensions, technical modifications, complication rates (total flap loss, partial flap loss, orocutaneous fistula, wound dehiscence, infection, donor site morbidity), functional outcomes, and hospital stay. Data were tabulated and summarized descriptively.

RESULTS

1. Overview of Included Studies

Eleven studies met the inclusion criteria, published between 1989 and 2021 (Table 1). These studies were conducted from major healthcare centres in India such as - Tata Memorial Hospital (2 studies); All India Institute of Medical Sciences (2 studies); Gujarat Cancer Research Institute (1 study); Banaras Hindu University (1 study); Christian Medical College (1 study); and other regional institutions. Collectively, the studies reported on 1,141 patients (range 12–232 per study), with a strong male predominance (approximately 80–95% male in most series). The mean age ranged from 35 to 59 years across studies.

Table 1: Summary of Included Studies on Bipaddled/Bilobed PMMC Flap Reconstruction

<i>First Author (Year)</i>	<i>Period of study</i>	<i>N</i>	<i>Male:Female</i>	<i>Mean Age</i>	<i>Primary Site</i>
Bhathena & Kavarana (1989) ¹⁴	1982-1987	53	43:10	NR	Buccal mucosa (44), FOM (9)
SVS Deo et al (2003) ¹⁷	1993-2001	54	40:14	51	Lateral (39), central (15)
QG Ahmad et al (2006) ¹⁸	2000-2004	47	47:0	49.5	Buccal mucosa
Bhola et al (2014) ¹⁹	2007-2012	62	62:0	45.6	Buccal/GBS (53), +lip (9)
Deo RP et al (2020) ²⁰	2013-2019	61	15:46	50-70	Lower GBS
PK Sahu et al (2020) ²¹	2017-2018	12	12:0	59.2	Buccal mucosa with skin
V Konduru et al (2020) ²²	2017-2019	41	28:13	48.3	GBC(39), tongue(1),sarcoma (1)
D Jayaprakash et al (2021) ²³	2018-2019	80	0:80	48	Buccal mucosa
P Kaul et al (2021) ²⁴	2018-2019	72	67:5	44	Bucco-alveolar (≥ 10 cm)

Neville JF et al (2021) ²⁵	2016-2020	232	219:13	49.5	Lower alveolus (145), buccal (78)
K Nandy et al (2021) ²⁶	2019	150	96:54	45	GBS (39%), buccal (30%)

*FOM: floor of mouth; GBS: gingivobuccal sulcus; GBC: gingivobuccal complex; NR: not reported

2. Flap Survival and Major Complications

Total flap loss (complete necrosis) occurred in 0–6% of patients across studies, with most series reporting rates below 3% (Table 2). The lowest rates were observed in the more recent large series: Neville et al. (0.9%, 2/232), Nandy et al. (1.3%, 2/150), and Konduru et al. (0%, 0/41).^{22,25,26} Bhathena's original series reported three total losses (6%) among 53 patients.¹⁴

Partial flap necrosis defined as necrosis of either the external or internal skin paddle—was more common, ranging from 0% to 20.8%. Neville et al. reported 6.5% full-thickness external paddle necrosis, with 40% of these occurring in females despite females constituting only 5.2% of their cohort.²⁵ Ahmad et al. noted 2.1% partial necrosis, while Bhola et al. reported differential necrosis in two cases (3.2%).^{18,19}

Overall complication rates varied widely from 13% to 63%, reflecting different definitions and thresholds for reporting minor events. The Clavien-Dindo grading system was employed in several recent studies to standardize reporting. Neville et al. reported overall morbidity of 33.8% (Grade I: 9.5%, Grade II: 69.7%, Grade IIIA: 13.4%, Grade IIIB: 7.45%).²⁵ Kaul et al. reported major complications (Grade III) in 25.1% and minor in 16.6%.²⁴

Table 2: Flap Outcomes and Complications Across Studies

First Author (Year)	Total Flap Loss	Partial Flap Necrosis	Orocutaneous Fistula	Wound Dehiscence	Wound Infection	Donor Site Complications
Bhathena & Kavarana (1989) ¹⁴	3 (6%)	NR	4 (8%)	NR	NR	NR
SVS Deo et al (2003) ¹⁷	1 (1.9%)	2 (3.7%)	NR	4 (7.4%)	NR	Seroma 3 (5.6%)
QG Ahmad et al (2006) ¹⁸	1 (2.1%)	2 (4.2%)	1 (2.1%)	6 (12.8%)	4 (8.5%)	Chest infection 6 (12.8%)
Bhola et al (2014) ¹⁹	0	2 (3.2%)	NR	12 (19.4%)	NR	5 (8.1%)
Deo RP et al (2020) ²⁰	1 (1.6%)	3 (4.9%)	NR	4 (6.5%)	NR	NR
PK Sahu et al (2020) ²¹	0	1 (8.3%)	NR	1 (8.3%)	1 (8.3%)	0
V Konduru et al (2020) ²²	0	6 (14.6%)	NR	2 (4.9%)	NR	NR
D Jayaprakash et al (2021) ²³	3 (3.75%)	9 (11.25%)	NR	12 (15%)	15 (18.75%)	13 (16.25%)
P Kaul et al (2021) ²⁴	1 (1.4%)	10 (13.9%)	5 (6.9%)	11 (15.2%)	6 (8.3%)	6 (8.3%)
Neville JF et al (2021) ²⁵	2 (0.9%)	15 (6.5%)	21 (9.1%)	32 (13.8%)	26 (11.2%)	8 (3.4%)
K Nandy et al (2021) ²⁶	2 (1.3%)	8 (5.3%)	3 (2%)	39 (26%)	13 (8.7%)	13 (8.7%)

3. Specific Complications and Their Management

Orocutaneous fistula occurred in 2–9.1% of patients. Neville et al.²⁵ reported 21 fistulas (9.1%), with two-thirds located on the superior suture line (bite composite resections involving palate) and one-third at the mandibular stump. Most fistulas healed with conservative management (dressings, antibiotics, nutritional support), though 11 required re-suturing.

Wound dehiscence was the most frequently reported complication, occurring in 4.9–26% of patients. Dehiscence at the recipient site (neck or cheek) was more common than at the donor site. Most cases were managed conservatively or with secondary suturing under local anesthesia.

Donor site morbidity was generally low. Primary closure was achieved in 66–100% of patients across series. Split-thickness skin grafts were required only for very large flaps or when primary closure was under tension. Donor site infection (4–13%) and hematoma (0–3.45%) were reported but rarely required surgical intervention.

4. Functional and Cosmetic Outcomes

Oral feeding was typically resumed between postoperative days 7 and 21. Sahu et al. reported a mean of 7.5 days; Neville et al. reported a median of 21 days (range 16–51). The wide variation reflects differences in defect extent, mandibular resection, and institutional protocols.

Mouth opening (interincisal distance) averaged 3.5–3.85 cm in studies reporting this parameter, adequate for oral intake and oral hygiene.

Dysphagia was assessed in several studies. Neville et al.²⁵ reported Grade 1 dysphagia in 58.9%, Grade 2 in 32%, and Grade 3 in 9.1%. Konduru et al.²² noted that most patients achieved acceptable swallowing function, though those with angle-of-mouth resections experienced drooling requiring bolus modification.

Speech was described as "perceptible" or "acceptable" in >90% of patients across studies, with only those undergoing total glossectomy or extended resections requiring permanent tracheostomy (approximately 5% in Nandy et al series).²⁶

Cosmetic outcomes were generally satisfactory, though the flap's bulk and color mismatch (particularly in fair-skinned individuals) were noted as limitations. Nipple-areola sacrifice was necessary in some horizontal paddle designs but was avoided where possible using paramedian or "C"-shaped incisions (Konduru et al.).²²

5. Factors Influencing Complications

Several studies analyzed risk factors for flap complications:

Female gender was consistently associated with higher complication rates. Neville et al. reported that 33% of females in their cohort experienced flap necrosis despite comprising only 5.2% of patients.²⁵ Kroll et al. similarly noted a predilection for flap necrosis in females due to intervening breast tissue increasing shearing risk.²⁷ Jayaprakash et al.'s dedicated study of 80 females reported 33.75% overall complications, with 15% flap loss (3.75% total, 11.25% partial).²³

Defect size and flap area correlated with morbidity. Kaul et al.²⁴ found that defect largest dimension ≥ 10 cm and flap area ≥ 76 cm² were significantly associated with major complications ($p < 0.05$). Patients with flap area > 100 cm² had higher rates of partial necrosis.

Neoadjuvant chemotherapy was associated with increased complications in some but not all studies. Nandy et al.²⁶ found NACT to be a risk factor on univariate analysis (53.3% of flap necrosis occurred in NACT recipients, $p = 0.038$) but not on multivariate analysis.

Diabetes mellitus was not consistently associated with increased complications, though individual studies reported higher infection rates in diabetic patients.

Technical Considerations and Modifications

1. Vascular Anatomy and Perforator Basis

The blood supply to the bipaddled flap relies on the thoracoacromial artery's pectoral branch, which runs on the undersurface of the pectoralis major muscle. Freeman et al. demonstrated rich anastomoses between the pectoral branch, internal mammary artery (via intercostal perforators), and lateral thoracic artery.^{28,29} Kiyokawa et al.³⁰ identified three distinct perforator clusters (designated P1, P2, P3) that nourish the overlying skin:

- P1: Perforators along the medial edge of the muscle from the internal mammary artery
- P2: Perforators 2–4 cm medial to the nipple from anterior intercostal branches
- P3: Fine branches curving around the lateral border of the muscle

Ahmad et al. designed their bipaddled flap to utilize these distinct perforator territories: the medial paddle (for external cover) based on P1, and the lateral paddle (including the areola for mucosal lining) based on P2 and P3.¹⁸

2. Flap Design and Orientation

Two main paddle orientations have been described:

Horizontal (transverse) paddles: The skin island is oriented horizontally across the chest, extending from the parasternal region medially to beyond the anterior axillary line laterally. This design maximizes flap width and is preferred for lateral cheek defects. The lateral paddle (often including the nipple) is used for intraoral lining; the medial paddle provides external cover.^{14,18,19}

Vertical (paramedian) paddles: The skin islands are oriented vertically along the axis of the pectoralis major muscle. The proximal (superior) paddle is used for mucosal reconstruction and the distal (inferior) for skin cover—or vice versa depending on pedicle length. This design is preferred for central defects (floor of mouth, chin) and in females to avoid breast tissue.^{17,22,23}

Oblique/"banana" or "mango" design: A curvilinear "C" or "boomerang" shape centred inferomedially to the nipple-areola complex, allowing primary donor site closure without dog-ears and preserving the nipple. This design has gained popularity for its improved cosmesis and reliability.^{22,25}

3. Mandibular Reconstruction

Bhathena et al. incorporated a vascularized segment of the 5th rib (up to 7 cm) into the bipaddled flap (osteomyocutaneous flap) for mandibular arch reconstruction in six patients.¹⁴ This technique provided skeletal support for middle-third mandibulectomy defects. However, some authors used titanium reconstruction plates for mandibular continuity, with the muscle wrapped around the plate to prevent late exposure.^{17-19, 25}

For lateral mandibular defects (not crossing the midline), most authors did not perform bony reconstruction, relying on the flap's bulk to prevent jaw deviation and a dental guide plane prosthesis to maintain occlusion.³¹

4. Female-Specific Modifications

Reconstruction in females presents unique challenges due to breast tissue interposed between the skin paddle and underlying muscle, increasing the risk of shearing and perforator damage.²⁷ Several modifications have been proposed:

Parasternal/paramedian approach (Chaturvedi et al., Mehta et al.): The skin paddle is placed over the parasternal region (2nd-4th intercostal spaces) where breast tissue is thinnest, using a vertical or oblique incision that preserves breast contour.^{32,33}

Submammary approach (Jayaprakash et al.): The skin paddle is designed through an inframammary incision, dissecting above the breast capsule to minimize breast tissue inclusion. This oncoplastic technique preserves breast aesthetics.²³

Medial paddle placement (Konduru et al.): The "C"-shaped design centers the skin paddle inferomedial to the nipple-areola complex, completely avoiding breast parenchyma and allowing primary closure without nipple distortion.²²

Despite these modifications, female gender remains a risk factor for complications, and some authors (Kaul et al.) now avoid extended bipaddled flaps (>10 cm defect dimension) in females, recommending free flaps or dual pedicled flaps instead.²⁴

5. Pedicle Lengthening Techniques

Insufficient flap reach—particularly in patients with long necks or short thoraces—can be addressed by several maneuvers:

- a. Sacrifice of clavicular fibers (Deo, Nandy): The clavicular head of pectoralis major is divided along the axis of the pedicle, eliminating the supraclavicular hump and adding 4-6 cm of effective length.^{17,33}
- b. Coplanar rotation (Sharan et al.): The skin paddle is rotated 180° along the pedicle axis in the same plane, avoiding twisting and providing an additional 7-8 cm of reach.³⁴
- c. Zigzag muscle incisions (Nandy et al.): Relaxing incisions placed from the medial border to 1 cm from the pedicle, then back to the medial border, yield 6-7 cm of extra length.²⁶
- d. Complete pectoralis detachment: The muscle is fully detached from the clavicle, converting the flap to a completely pedicled design—though this risks pedicle injury if dissection extends too deep.³⁴

6. Donor Site Closure

Primary closure of the donor site was achieved in the majority of patients across all series (66–100%). Key principles include:

- Wide undermining of chest skin flaps
- Tapered (triangular) ends of the skin paddle to prevent dog-ears
- "C"-shaped or "boomerang" incisions that redistribute tension (Konduru)
- Closure in layers with suction drainage
- Use of split-thickness skin grafts only when primary closure impossible (typically for flaps >15-18 cm in length)

DISCUSSION

1. The Role of Bipaddled PMMC Flap in the Free Flap Era

Microvascular free tissue transfer is unequivocally the gold standard for complex head and neck reconstruction.^{35,36} Free flaps offer several advantages: customized tissue composition (skin, fat, fascia, muscle, bone), superior color match, reduced bulk, primary closure of donor sites, and lower rates of certain complications like orocutaneous fistula.^{37,38} The radial forearm free flap, anterolateral thigh flap, and fibula osteocutaneous flap have become workhorses in centers with microvascular capability.^{39,40}

However, the bipaddled PMMC flap retains important indications:

Resource-limited settings: In LMICs, the high cost of microvascular equipment, need for specialized training, prolonged operative times (typically 6-10 hours vs. 3-5 hours for PMMC), and intensive postoperative monitoring limit free flap availability.^{41,42} Bhathena et al. reported that among 600 PMMC reconstructions at Tata Memorial Hospital, only 53 required the bipaddled modification—but for those patients, it provided a definitive single-stage solution.¹⁴

Salvage reconstruction: Following free flap failure (reported in 5-10% of cases), the ipsilateral or contralateral PMMC flap serves as a reliable backup.⁴³ Nandy et al. used contralateral PMMC flaps for salvage after complete flap loss in two patients.²⁶

Patient factors: Patients with poor nutritional status, advanced age, significant comorbidities, or previous radiotherapy to recipient vessels may be poor candidates for prolonged free flap surgery.⁴⁴ The PMMC flap's robust, independent blood supply—often unaffected by neck radiotherapy—makes it attractive in these scenarios.⁴⁵

High-volume centers: In busy cancer hospitals performing 6-7 major resections daily, the shorter operative time and lower resource intensity of PMMC flaps allow efficient patient throughput without compromising outcomes.³⁴

2. Comparison of Outcomes with Free Flaps

Direct comparison between bipaddled PMMC and free flaps is complicated by selection bias (free flaps are typically used for more complex defects) and the lack of randomized trials. However, some observations can be made:

Flap survival: Total flap loss for free flaps in oral reconstruction is 2-5%; for bipaddled PMMC, it is 0-6%—broadly comparable.⁴⁶ Partial flap loss is more common with PMMC (5-20% vs. 2-5% for free flaps), reflecting the distal random component of large skin paddles.

Fistula rates: Reported orocutaneous fistula rates for free flaps range from 3-15% versus 2-9% for bipaddled PMMC—similar.⁴⁷

Functional outcomes: Free flaps generally provide superior speech and swallowing outcomes for total glossectomy and extensive tongue defects.⁴⁸ For lateral buccal and GBS defects, functional results with PMMC are acceptable, with most patients resuming oral diets and intelligible speech.^{21,25}

Cosmesis: Free flaps offer better color match and less bulk, though the PMMC's bulk can be advantageous for filling dead space and protecting the carotid artery.⁴⁹ Modern modifications (paramedian paddles, nipple preservation) have improved PMMC cosmesis considerably.

Hospital stay: Mean hospital stay for bipaddled PMMC ranges from 6-18.5 days; free flaps typically require 10-21 days—a modest difference.^{33,50}

Cost: In the Indian healthcare context, PMMC flap reconstruction costs approximately 20-30% of a free flap procedure, a critical consideration for the majority of patients who pay out-of-pocket.⁵¹

3. Complication Prevention: Lessons from Large Series

Analysing recommendations from the reviewed studies, the following principles emerge for minimizing bipaddled PMMC complications:

Preoperative planning:

- Measure defect dimensions accurately; avoid flaps >15 cm in length or >100 cm² in area in high-risk patients
- Design skin paddle within pectoralis major territory (4th-6th intercostal spaces, not below 7th rib)
- Preserve deltopectoral flap territory as a salvage option
- In females, use paramedian or submammary approaches; consider alternative reconstruction for large defects

Intraoperative technique:

- Suture skin paddle to underlying muscle before elevation (prevents shearing)
- Use cutting cautery or knife; avoid coagulation near perforators
- Identify and divide lateral pectoral nerve (prevents postoperative muscle contraction)
- Create a spacious supraclavicular tunnel (3-4 finger breadths)
- De-epithelialize rather than incise the bridge between paddles when possible
- Obtain tension-free inset; if reach is inadequate, employ lengthening maneuvers before forcing the flap
- For mandibular defects, wrap reconstruction plates with muscle

Postoperative care:

- Maintain normotension (avoid hypotension)

- Aggressive oral hygiene (chlorhexidine, diluted hydrogen peroxide)
- Start nasogastric feeding on day 1 (25-30 kcal/kg/day)
- Allow oral sips early to maintain hygiene; full liquids at day 5-7
- Remove neck straps/tracheostomy ties that may compress pedicle
- Monitor for early signs of venous congestion or arterial insufficiency

4. Limitations of the Evidence

This review has several limitations. First, most of the studies are retrospective case series without control groups, subject to selection bias and variable reporting standards. Second, complication definitions vary across studies, making direct comparison challenging. Third, few studies used validated outcome measures (e.g., EORTC QLQ-H&N35 for quality of life), limiting assessment of functional outcomes. Fourth, follow-up durations are inconsistent, with most studies reporting only short-term (<1 year) outcomes. Finally, publication bias may favor studies with favorable results.

5.5 Future Directions

Several areas warrant further investigation:

Prospective comparative studies: Randomized trials or well-designed prospective cohort studies comparing bipaddled PMMC with free flaps (radial forearm, ALT) for specific defect types would clarify optimal indications.

Enhanced recovery protocols: Standardized perioperative care bundles could reduce complication rates and hospital stay.

Perfusion assessment: Intraoperative indocyanine green (ICG) angiography could identify poorly perfused portions of the flap, allowing intraoperative revision and reducing partial necrosis.⁵²

Female-specific designs: Further refinement of oncoplastic techniques to preserve breast aesthetics while ensuring flap reliability is needed.

Functional outcomes research: Validated instruments should be routinely employed to assess speech, swallowing, and quality of life.

CONCLUSIONS

The bipaddled pectoralis major myocutaneous flap is a reliable, versatile, and effective reconstructive option for complex full-thickness oral cavity defects following cancer ablation. With total flap loss rates of 0-6% and acceptable functional and cosmetic outcomes, it compares favorably with free tissue transfer in selected patients and settings.

The flap's primary advantages—technical simplicity, short operative time, low cost, and independence from microvascular expertise—make it indispensable in resource-limited environments where the burden of oral cancer is highest. Moreover, its role as a salvage flap following free flap failure and in patients unsuitable for prolonged microsurgery ensures its continued relevance even in high-resource centers.

Technical refinements over four decades—including horizontal and vertical paddle designs, paramedian incisions for females, pedicle lengthening maneuvers, and vascularized rib incorporation—have expanded its indications and improved outcomes. However, patient selection remains critical: large defects (>15 cm flap length), female gender, and previous radiotherapy increase complication risk, and in such cases, free flap reconstruction should be preferred when available.

The bipaddled PMMC flap has stood the test of time. While free flaps represent the gold standard, the bipaddled PMMC remains a workhorse—not of the past, but of the present and foreseeable future in global head and neck oncology.

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