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ORIGINAL ARTICLE

Assessment of Masticatory Function in Oral Cancer Patients with Mandibulectomy Followed by Pectoralis Major Myocutaneous Flap Reconstruction

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Abstract
Mandibular resections have a dramatic effect on oral cavity functions. Ablative surgical defects are complex which are better reconstructed with free flaps. In developing countries like India, where majority of patients come from low socioeconomic status, pectoralis major myocutaneous flap is the most preferred reconstructive option. A retrospective questionnaire study was carried out to assess the mastication in patients with mandibulectomy followed by pectoralis major myocutaneous flap reconstruction. At the end of the study, it was observed that 86.6% of the patients had a good performance despite the lack of bony reconstruction. Thus, pectoralis major myocutaneous flap still stands strong in reconstructing large oral cavity defects.

Keywords Mandibulectomy · Mastication · Pectoralis major flap · Oral cancer

Introduction

Oral cavity is known for its functional and esthetic significance. Ablative surgical defects lead to functional disability. The dictum is to replace like tissue with like tissue. In the free-flap era, free tissue transfer is most preferred compared with the conventional reconstruction methods. In comparison to the free flaps that offer a wide array of reconstructive options, pectoralis major myocutaneous flap (PMMC) still remains the most employed reconstructive option worldwide [1]. The objective of the present study is to assess the postoperative masticatory functions of patients who have had mandibular resections for oral cancer and immediate reconstruction with PMMC flap.

Materials and Methods

A retrospective study was conducted in the Department of Surgical Oncology to assess the masticatory function in the post-mandibulectomy oral cancer patients, who underwent immediate reconstruction with PMMC flaps. Forty oral cancer patient's data were retrieved from the medical records who were treated with PMMC reconstruction post-mandibulectomies from the 2016 Sept. to 2018 Dec. Demographic details including age and gender and other surgical details like site of the lesion, tumor stage, extent of resection, flap design, potential complications, and treatment history were collected from the medical records.

Oral cancer patients who underwent mandibulectomy (posterior segmental or hemimadibulectomy) with immediate PMMC flap reconstruction with or without post-op radiotherapy with a minimum post-radiotherapy follow-up of 3 months were included in the study. The exclusion criteria included: patients who failed to follow up, presented with local recurrence, received prior treatment, marginal mandibulectomy performed, or cases where other flap reconstruction was done.

Patients who are in regular follow-ups were personally interviewed in their vernacular language by the operating surgeon using performance status scale for head and neck cancer patients (PSS-HN). The questionnaire was comprised of three components: normalcy of the diet, public eating, and understandability of speech. The study was aimed at assessing site-specific function (mastication); hence, special attention was placed on normalcy of diet. The maximum scoring was 100 and minimum was 0 for normalcy of diet. Each patient was questioned on the consistency of food consumed and was scored accordingly.

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Results

Of 40, six failed to follow up, two had recurrence and were receiving palliative care, and two had expired. Finally, 30 patients were enrolled in the study (M = 20, F = 10). The age ranged from 26 to 70 years. The site of the lesion, stage of the disease, type of resection, and mode of reconstruction is as depicted in Tables 1 and 2. In all cases, comprehensive neck dissection was performed. Resection and reconstruction was performed by a single surgeon. Sixteen patients received adjuvant therapy. The minimum follow-up was 2 months post-radiotherapy and 2 months post-surgery. Flap-related complications were seen in 2 patients. A subscale of > 50 was scored in 26 patients and < 50 in 4 patients. In all cases, 86.67% had a good performance.

Discussion

Mandible serves a major role in the vital functions of the oral cavity like speech, swallowing, mastication, and respiration. It harbors the lower dentition, provides attachment to the muscles of floor of mouth and mastication, and defines the contour to the lower one-third of the face [2]. Oral cancer ablative surgeries often interfere with these essential functions. Mandible is resected when infiltrated by the oral cancer or in order to achieve clear surgical margins. Loss of mandibular continuity results in occlusal disharmony and deviated mandible. The post-ablative defects have deleterious effect on functions, cosmoses, and social well-being of the patient. Reconstruction and rehabilitation is often challenging as the defects are three dimensional.

Various reconstructive options are available to reconstruct the mandibular defects, of which free fibula is the most preferred as it provides maximum bone segment and good bone stock [3]. In low socioeconomic situations or set ups which lack adequate infrastructure, PMMC flap is predominately used.

Management of oral cancer requires a balance between cure/palliation and providing optimum quality of life. Mandible plays a key role in mastication; its resection will have a detrimental effect on mastication. Mastication is a significant parameter that has to be assessed in all oral cancer patients who undergo mandibulectomies. Through this study, we aim to assess site-specific function, as it will help to precisely asses the function and will encourage in improving the quality of life of these patients.

Table 1 Type of resections performed

Type of resection	Number
Hemimandibulectomy	13
Posterior segment mandibulectomy	5
Posterior segment mandibulectomy with partial glossectomy	2
Bite resection	9
Extended hemimandibulectomy with hemiglossectomy	1

Table 2 Type of reconstruction

Type of reconstruction	Number
PMMC alone	25
Bipaddle	3
Dual flaps	2

A variety of validated questionnaires are available to assess QOL. Our research opted performance status scale for head and neck cancer patients (PSS-HN) because it is patient based, simple, and easily understood. It is a broad questionnaire assessing in detail the diet. PSS-HN is a unique instrument to measure the functional impairment in HNC patients. A subscale of < 50 signifies moderate to severe impairment, > 50 is defined as good performance [4].

The age in the present study ranged from 26 to 70 years. Both the extremes had good functions. There was no significant difference in age. In the literature, there are studies supporting variability in gender with functions and HRQOL [5, 6]. In the present study, 75% of the male patients were on full diet while only 40% of female patients were on full diet. Most of our patients presented with some degree of occlusal discrepancy. Over time, this discrepancy settled. However, in female patients, the flap was more bulky leading to increased mandibular deviation and persistence of occlusal discrepancy. Hence, most of the females were on liquid-assisted diet (50%).

Of the 30 cases, five patients in our series are on soft diet. In two cases, extensive buccal mucosa and retromolar trigone (RMT) excision along with infratemporal fossa (ITF) clearance was done. In the remaining three, lesion was extended medially to involve the lateral border of the tongue. Extended hemimandibulectomy with hemiglossectomy was done in one patient, and in other two, lateral border of the tongue was excised. Tongue resection had a dramatic effect on mixing ability and swallowing. Therefore, in cases where extensive resections were performed, there was moderate-severe functional impairment (score < 50) and there was an increased degree of mandibular deviation leading to malocclusion and impairing of the masticatory efficacy. Hard and soft tissue resection will reflect on the functions, proving the negative effect of increase in size of the defect on function. Lesions extending to involve the soft palate, ITF, and above the zygoma are challenging to reconstruct. Such defects can be reconstructed with dual flaps or with free flaps. Results of dual flaps are inferior directing the need of bulky soft tissue flaps [7]. Caroline et al. hypothesized that tongue resection will significantly impair masticatory function. Mixing and swallowing ability was deteriorated in these patients. Patients treated with surgery alone performed better than surgery with adjuvant therapy [8].

An interesting study was carried out by Haribhakti et al. to assess the oral cavity function following locoregional reconstruction. The major conclusion from the study that was drawn is that the mastication and occlusal impairment was directly proportional to the extent of mandibulectomy and magnitude of soft tissue resection. In their study cases where mandible was preserved, the functional outcome was definitely better. Extensive soft tissue resections lead to poorer functions. Dual-flap reconstruction functions were inferior to single-flap reconstruction [9]. In our series, 24 patients were reconstructed with PMMC alone. In all cases, 62.5% were on full diet and 37.5% on liquid-assisted diet. In three cases where bipaddle flap was done, two were on full diet (66.6%). Two cases were reconstructed with double flap, masseter in one, and DP in the other, only one patient was on full diet (50%). In a single patient, the skin defect was closed primarily. The patient was on liquid-assisted diet. Primary closure leads to increased fibrosis, in turn leading to greater deviation. Thus, cases with single flap and bipaddle flap performed better masticatory function as compared with other flaps. Our results are comparable with that of Haribhakti et al.'s results.

Effective mastication is possible when there is synchrony between hard and soft tissues. Composite resections can be better replaced with free flaps. Free flaps have a lot to offer. They provide faster and more effective rehabilitation [10]. Savant et al. presented a series of 114 patients reconstructed with pectoralis major osteomyocutaneous flap (PM-OMC). In their series, most of their patients had no issues with speech, swallowing, mastication, or articulation. Denture fabrication was done after a span of 8–10 weeks [11]. When pedicle flaps are used, guide plane prosthesis can be fabricated to prevent mandibular deviation. However, Haribhakti et al.'s study mentioned no functional advantage over guide plane prosthetic placement [9]. In our series, patients with malocclusion were referred for prosthetic rehabilitation. None of them have benefited with the guide plane prosthesis. Anatomic loss has a great impact on function. Mandibular prosthesis is seldom of benefit when there is lack of tongue movements. Many investigators have supported this fact through their work.

Curtis et al. compared masticatory function in reconstructed and non-reconstructed patients. Both the groups had significant functional deficit when compared with the control group. Reconstructed patients performed better than non-reconstructed patients [12]. Tsue et al. have analyzed through their work that patients with free fibula flaps had better eating ability when compared with PMMC-reconstructed patient. This justified the increased cost of surgery in free-flap patients [13].

A questionnaire study by Hsing et al. concluded no significant difference in chewing function among patients that were reconstructed with PMMC when compared with free flaps. Functions like speech, shoulder movement, and mood stability were much better in free-flap patients [14].

Mosahebi and co-workers have reconstructed posterolateral mandibular defects with non-osseous free flaps. Majority of the patients in their series were on oral diet during their hospital stay [15].

One of the largest series in literature comparing the two flaps, anterolateral thigh (ALT) and pectoralis major myofascial (PMMF) flaps, in oral cavity reconstruction was carried out by Xiao et al. [16]. Similar results are reported by Zhang et al. In their experience, there was no significant difference between the two groups with respect to chewing function [17]. O'Neill et al. carried out a study comparing PMMC with radial forearm flap (RFF) in reconstruction of oral and oropharyngeal defects. Their study outlined no difference between the two groups with chewing function.

Free flaps are superior to conventional flaps when it comes to cover extensive defects. Extent of resection is the key factor that guides reconstruction. In a single case, the reach of PMMC was inadequate superiorly and posteriorly. Defect was closed using PMMC along with Masseter flap. Patient was on puree diet. In such situations, harvesting a bulky soft tissue flap like ALT will offer better results [7]. PMMC uptake was 100% with minor complications like partial-flap necrosis which was seen in only two cases (6.6%). Of the two, one patient has coped up and is on liquid-assisted diet (stage I), while the other patient is on puree diet. The second patient had an extensive resection (stage IV).

Talking about the post-surgery period, none of them required ICU monitoring. Most of our patients were discharged by the 8th day. At the time of discharge, oral water feeds was started, and on 10th day oral feeds were started, provided the healing was satisfactory. Prior to radiation, all our patients were on oral diet. None of our patients stayed on Ryle's tube for a long duration except the one with extended hemimandibulectomy and the ones with flap complications. Both patients required debridement. Debridement was done on OPD basis. These patients started on oral feeds once the wound healed. Of the two partial-flap necrosis patients, only one patient was advised adjuvant therapy. The adjuvant therapy was started within 6 weeks.

Over decades, there are three major points debated on free flaps and PMMC: function, morbidity and cost. In developing countries like India, cost is a major factor. PMMC can be considered an alternative to free flaps in low socioeconomic stature, health care set ups with limited infrastructure, elderly individuals with existing co-morbidities, and in high-volume centers, treating patients with financial constrains where time is also a crucial factor [3, 13, 18, 19, 20].

Limitations of Our Study

Our study lacked to compare masticatory function with free fibula–reconstructed patients. Prosthetic rehabilitation is essential for better mastication which was not assessed in our series.

Conclusion

In the free-flap era, the age old PMMC flap can still be effectively used to reconstruct major oral cavity defects. Despite the lack of bony replacement, 86.6% of patients had good performance. The facial form and functions were well restored in our patients. This influences the continued use of "workhorse" flap in oral cavity reconstructions, and hence it remains the most utilized reconstructive flap.

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