Soft Tissue Reconstruction After Hemimandibulectomy in Oral Malignancies: A Retrospective Study

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Abstract

Aims The present study was under taken to evaluate the efficacy of various local and regional soft tissue flaps used for reconstruction after excision of various malignant lesions of the mouth and also to evaluate complications with length of hospital stay after the reconstruction.

Materials and Methods The study was a record based retrospective analysis of 127 patients who were histologically proven squamous cell carcinoma of the oral cavity for which excision of the lesion along with segmental mandibulectomy and primary reconstruction with local or regional flaps was the treatment modality.

Results The male:female mean age is 48.27:48.79. The Z-proportionality test for intra oral reconstruction showed 5% level of significance ($P < 0.05$) between pectoralis major myocutaneous flap (PMMC) and other flaps. Difference between deltopectoral (DP) and PMMC, PMMC and primary closure at 1% level of significance, i.e. $P < 0.01$ was found for extra oral defects. The mean stay

was found to be 31.31 days. Recurrence rate of 11% was reported.

Conclusion A total of 127 patients formed the study group. In the absence of bone reconstruction PMMC still continues to be the “work horse” of reconstruction following wide excision and hemimandibulectomy.

Keywords Oral malignancies · Hemimandibulectomy · Pectoralis major myocutaneous flap · Complications

Introduction

The oral cavity is an anatomic structure composed of specialized tissues, which function together and comprises of a regional physiologic unit referred to as the stomatognathic system. The most essential structural element of the stomatognathic system is the mucosal integument. The most important function of this integument is necessarily protection, i.e. forming a protective barrier against adverse environmental factors in the oral cavity. The clinical and the morphological changes observed in this mucosal interface are for most part, a result of the interaction of both these intrinsic and extrinsic factors. Because of the different etiological factors at work in the oral cavity and the easy way with which endogenous or exogenous factors may disturb the balance, it is to be expected that an unlimited variety of manifestations of local and systemic disorders might be observed in these tissues.

Carcinoma of the oral cavity is the second most common form of cancer in India and most of the patients affected are of low socioeconomic status with the habits like tobacco smoking or chewing and excessive consumption of alcohol. Usually by the time patients report to

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the hospital the disease will be in a very advanced stage, which would necessitate extensive ablative surgery including neck dissection, chemotherapy, tumor control and survival remains elusive.

Although great progress has been achieved in the reconstructive surgery in recent times [1], successful mandibular reconstruction still remains a challenge to reconstructive surgeons. Loss of a mandibular segment results in serious disabilities [2], including impairment of chewing, swallowing speaking and articulation; poor control of salivary secretions and moderate to severe cosmetic disfigurement, the degree of disability varies with the size and location of the defect [3, 4].

The role of the reconstructive surgeon is to replace missing tissues and to restore the important functions of the oral cavity [5, 6]. Restoration of mandibular defects has evolved through several stages. For almost a century the surgeons have tried different techniques [6–8]. These are basically classified into free bone grafting, alloplastic materials, freeze dried bone, osseomyocutaneous flaps or free tissue grafts. Contamination with oral micro organisms poses a unique problem unseen in osseous reconstruction of the other parts of the skeleton, furthermore no single method of reconstruction can be universally applied to all segmental mandibular defects with a predictable high rate of success.

The present study was undertaken to evaluate the efficacy of various local and regional soft tissue flaps used for reconstruction after excision of the malignant lesions in the mouth, which involves the mandible, the flap used for particular case depends often on various factors; including the size of the defects, esthetics and functional aspects and operative preference [9]. It is therefore important to conduct a retrospective study to compare the complications and the length of hospital stay with different methods of reconstruction.

Materials and Method

This study was conducted in the Department of Oral and Maxillofacial Surgery; S.D.M. College of Dental Sciences, Dharwad in conjunction with Karnataka Cancer Therapy and Research Institute, Navanagar, Hubli, Karnataka. The study was a record based retrospective analysis of 127 patients who were histologically proven squamous cell carcinoma of the oral cavity for which excision of the lesion along with segmental mandibulectomy and primary reconstruction with local or regional flaps was the treatment modality with a period of 1 year follow up.

The main aim of the study is to critically evaluate the complications and the length of hospital stay with different flaps used for the primary reconstruction of intra oral and

extra oral defects which occurred after wide excision and hemimandibulectomy in oral malignancy.

The following parameters are considered for this evaluation:

- Pre and post surgical complications;
- Requirement of secondary procedures;
- Duration of hospital stay.

Various regional and distant flaps used for reconstruction of the defect are primary closure, pectoralis major myocutaneous flap (PMMC), deltopectoral myocutaneous flap (DP), forehead flap, latissimus dorsi flap, tongue flap.

The proforma was used for collecting the data and was analyzed. Mean percentage and Student's *t*-test was performed to see significant difference in the mean duration of hospital stay among the four groups and was calculated. A comparative statistical analysis was done among the different flaps used and their complications by Z-proportionality test for both intraoral and extraoral reconstruction. This statistical data was tabulated and graphed.

Results

A total of 127 patients were treated and analyzed in a period of 6 years with 1-year post surgical follow up. The maximum numbers of patients operated were in the age group of 41–50 years with an overall mean age being 48.41 years. The male:female mean age is 48.27:48.79 which showed no significant difference (Graph 1). On presentation pain was 74.02%, swelling in 40.94%, ulcer in 33.86% and trismus in 16.54% were the main complaints. Predominantly tobacco in the form of chewing or smoking or in combination was the major etiological factor in the group accounting for 89%. In the sample studied, 58% lesion involved lower alveolus and buccal mucosa with no significance to the side and site. It was found that it involved the area where the tobacco was placed by the

Graph 1 Data according to age and sex ($N = 127$)

subject. 58% had clinically palpable lymph nodes of which 25% was found in N1, 23% in N2b. The samples showed 80% of the diagnosed and treated were in stage IV, according to the classification given by international union against cancer (UICC). The dissected nodes were sent for pathology and the histopathological diagnoses of the resected nodes found to be 72% sensitivity and 79% specificity. Pre surgical radiotherapy was recommended in 4% of cases. The patients who underwent surgery are broadly divided into two groups, i.e. 82% of the patients underwent wide excision with radical neck dissection and hemimandibulectomy and reconstruction while 18% have undergone wide excision of the lesion with supraomohyoid neck dissection and hemimandibulectomy and reconstruction. During the surgical procedure, the flaps utilized were not only to close the intraoral defect but also to cover the extra oral defect in 82 cases with loss of skin as well as mucosa. Different flaps used for the intra oral defects closure and the extra oral defects are illustrated in Graph 2.

In our study we found that 82% of the subjects had no complications, only 18% had post operative complications. The details of the complications are illustrated (Tables 1,

Graph 2 Reconstruction intra-oral and extra-oral ($N = 127$)

Table 1 Distribution of data according to flap versus complication ($N = 103$ intraoral)

Flap	Expired	Nil	OCF	Partial necrosis	Total necrosis	Recurrence
PMMC	3	34	3	2	1	6
Primary closure	1	10	0	2	0	3
DP	0	0	0	0	0	0
Tongue	0	25	1	3	2	2
Others	0	0	0	1	0	4

Table 2 Distribution of data according to flap versus complication ($N = 24$ extraoral)

Flap	Expired	Nil	OCF	Partial necrosis	Total necrosis	Recurrence
PMMC	0	0	2	3	1	0
Primary closure	0	3	0	0	0	1
DP	0	8	1	2	1	2
Tongue	0	0	0	0	0	0
Others	0	0	0	0	0	0

2). Z-proportionality test for intraoral reconstruction was done and was categorized into four groups, i.e. other flaps used, PMMC, primary closure and tongue was 4.51, 11.28, 4.51 and 5.26%. According to Z-proportionality test which clearly indicates that there is a significant difference between PMMC visa primary closure, tongue flap and other flaps used for the intraoral reconstruction at 5% level of significance, i.e. $P < 0.05$ (Table 3). The extra oral reconstruction flaps were categorized into three groups, i.e. DP, PMMC and primary closure was 4.51, 11.28 and 4.51%, respectively. According to the Z-proportionality test which clearly indicates that there is a significant difference between DP and PMMC flap, PMMC flap and primary closure at 1% level of significance, i.e. $P < 0.01$ (Table 4).

The mean stay was found to be 31.31 days. 44% patients had a minimum stay of 16–30 days (Table 5). Table 5 shows the subject's distribution according to the flap used intra orally versus stay. The least mean stay of 27 days was found in the group who had undergone closure of the defect with primary closure followed by a mean stay of 30 days for PMMC flap intra orally. A mean stay of 32 and 37 days was found in the patients who had undergone the closure of

Table 3 Z proportionality test for intraoral reconstruction

Category	Percentage	Z-value	P-value	Significance
I	4.51	2.7326	<0.01	S
II	11.28			
I	4.51	0	>0.05	NS
III	4.51			
I	4.51	20.3552	>0.05	NS
IV	5.26			
II	11.28	2.7326	<0.01	S
III	4.51			
II	11.28	2.3961	<0.05	S
IV	5.26			
III	4.51	−0.3552	>0.05	NS
IV	5.26			

I others, II PMMC flap, III primary closure, IV tongue flap

Table 4 Z proportionality test for extraoral reconstruction

Category	Percentage	Z-value	P-value	Significance
I	4.51	2.7326	<0.01	S
II	11.28			
I	4.51	0	>0.05	NS
III	4.51			
II	11.28	2.7326	<0.01	S
III	4.51			

I deltopectoral flap, II PMMC flap, III primary closure

Table 5 Distribution of data according to flap versus total stay (N = 127 intra oral)

	<15 days	16–30 days	31–45 days	46–60 days	61–75 days	76–90 days
Pectoralis major	6	26	20	6	0	1
Others	1	3	4	2	1	0
Primary closure	3	14	5	3	0	0
Tongue	0	19	14	4	0	0

the defect with either a tongue flap or by other grafts. According to the Students *t*-test a statistical significance at 10% level of significance, i.e. $P < 0.10$ was found between the other flaps used and PMMC flap and the significance of 5% level of significance was found between the other flaps and primary closure. A statistical significance, i.e. $P < 0.10$ was found between the primary closure and tongue flap (Table 6).

The least mean stay of 29 days was found in the group who had not undergone any reconstruction. The subject's distribution according to the flap used extra orally versus

Table 6 Summary statistics of patients stay for intra oral reconstruction Student's *t*-test

Category	Mean	SD	<i>t</i> -value	P-value	Significance
I	30.8421	14.1645	18.131	>0.05	NS
II	36.5909	16.3301		<0.10	S
I	30.8421	14.1645	0.9762	>0.05	NS
III	27.74	12.8239			
I	30.8421	14.1645	−0.4289	>0.05	NS
IV	31.9189	10.1432			
II	36.5909	16.3301	1.6994	<0.05	S
III	27.74	12.8239			
II	36.5909	16.3301	1.1239	>0.05	NS
IV	31.9189	10.1432			
III	27.74	12.8239	−1.4051	>0.05	NS
IV	31.9189	10.1432		<0.10	S

I PMMC flap, II others, III primary closure, IV tongue flap

Table 7 Distribution of data according to flap versus duration of stay (N = 127 extra oral)

	<15 days	16–30 days	31–45 days	46–60 days	61–75 days	79–90 days
No reconstruction	3	27	15	4	0	0
Deltopectoral	1	5	6	4	0	0
Pectoralis major	6	26	19	5	0	1
Others	0	1	1	1	1	0
Primary closure	0	3	2	1	0	0

Table 8 Summary statistics of patients stay for extra oral reconstruction Student's *t*-test

Category	Mean	SD	<i>t</i> -value	P-value	Significance
I	29.0918	10.9519	2	>0.05	NS
II	35.1562	13.7897		<0.10	S
I	29.0918	10.9519	−0.5601	>0.05	NS
III	30.4483	14.0803			
I	29.0918	10.9519	−0.8192	>0.05	NS
IV	32.375	10.4359			
II	35.1562	13.7897	1.2382	>0.05	NS
III	30.4483	14.0803		<0.10	S
II	35.1562	13.7897	0.4955	>0.05	NS
IV	32.375	10.4359			
III	30.4483	14.0803	−0.4668	>0.05	NS
IV	32.375	10.4359			

I no reconstruction, II deltopectoral, III PMMC flap, IV primary closure

duration of stay (Table 7). The mean stay for the primary closure of the defect was 32 days where as the mean stay for PMMC was 30 days and DP had a mean stay of 35 days. According to the Student's *t*-test significance at 10% level of significance, i.e. $P < 0.10$ was found between the DP and no reconstruction (Table 8). There was also a similar significance between the DP and the PMMC flap with a *t*-value of 1.2382.

In 15 out of 127 patients a secondary procedures were carried out due to failure of the primary flap. Contra lateral PMMC flap was raised in three patients; secondary closure is attempted with success in five patients while the wound is left for granulation in seven patients. Recurrence of the disease with in a period of 1 year was found in 14 patients, i.e. a recurrence rate of 11%.

Discussion

The oral cavity as a whole is a complex anatomical entity which poses a big problem when large defects following ablative surgery for cancer needs to be reconstructed [2].

The problem is more complex when excision of a lesion involves the removal of the hard and soft tissue [3, 4] particularly in the mandible. Of late, newer techniques, using microvascular tissue transfer has provided a better solution. However, in the absence of expertise in these techniques large composite defects are usually reconstructed with only soft tissue [5, 10] if at all.

The study was a record based retrospective analysis of 127 patients who were histologically proven squamous cell carcinoma of the oral cavity for which excision of the lesion along with segmental mandibulectomy and primary reconstruction with local or regional flaps was the treatment modality with a period of 1-year follow up. Male:female ratio in the study group is 3:1. This is not surprising because the habits that predispose to oral cancer are found more commonly in men. Not surprisingly, the highest number of patients, i.e. 74% presented with pain. Since this is not an early symptom, it follows that most of the patients were in advanced stage of the disease. Use of tobacco, either in the form of chewing or smoking was seen in most of the patients. However, a large number of patients, i.e. 74% were tobacco chewers compared to 15% who were smokers. Involvement of the lower alveolus is a common finding because of the nature of the sample of the study. Majority of the patients, i.e. 58% had clinically palpable nodes at the time of presentation. This is in agreement with the stage of the disease at which most of the patients (80%) presented, i.e. stage IV. All the 127 patients had some form of neck dissection performed. 81% of them had radial neck dissection and the rest had supra omohyoid neck dissection.

Histologically, 65 of the patients had nodal metastasis. The sensitivity and specificity of the clinical findings was found to be 72 and 79%, respectively. These figures indicate that a staging procedure such as supraomohyoid neck dissection should be carried out even in the absence of clinically palpable lymph nodes, failing which about 20% of false negative cases will go undetected.

PMMC was the choice for the reconstruction of the resultant intraoral defect in a majority of patients, i.e. 44% [7]. In the absence of the bone reconstruction PMMC is the ideal flap for reconstruction and is rightly described as the “work horse” of the head and the neck reconstruction [11]. It is technically [12, 13] easy to raise the flap [14] and large amount of skin and muscle can be transferred with minimal morbidity at the donor site [15]. Locally available tissue in the form of tongue [8] is another option particularly where the defects are smaller and the patients general condition does not allow more extensive procedures. However, there is morbidity in the form of difficulty in articulation following this method of reconstruction. When there is an extra oral defect following the excision, PMMC still is the flap of choice [7] and has been used in 42% of cases in this

study population. However, a large number, i.e. 38% did not require any extra oral reconstruction. Deltopectoral flap, the “work horse” of an earlier era [6] is also used for reconstruction in 12% of the cases in the present study. PMMC has also been used as a single flap for the reconstruction for both extra oral and infra oral defects [16, 17] in 53 patients.

About 19% of our cases, i.e. 26 cases of 127 had some complications which are similar to complications encountered in other studies [18–20]. The complication of partial or total flap necrosis seen in 11% of our patients is also similar to the incidence mentioned in some of studies [12, 21]. The present study had mortality rate of 3%. Among the different flaps used for reconstruction of the intra oral defects a higher rate of complications was seen with the PMMC in comparison to the others [9]. Selection of the flap depends on the area and the size of the defect. Combinations of the several flaps are recommended [22]. This shows that though a better quality of reconstruction is obtained with locally available PMMC, they are associated with lesser degree of complications when compared with others [1]. Considering extra oral reconstruction, a higher rate of complications, i.e. 11.28% was associated with PMMC compared to no reconstruction or when deltopectoral flap is used for reconstruction. This finding was observed in other studies also [23, 24] and this was statistically significant (10%) in our cases. This confirms that though PMMC is a versatile flap, the margin of error is less when compared to no reconstruction or other flap in correlation with the studies done by Price and Davis, who have demonstrated the limitations of each flap in orofacial reconstructions [7].

Irrespective of the method of reconstruction, the method used must be cost effective. This is more so because a majority of the patients with oral cancer come from a low socio-economic status. Therefore, looking at the duration of hospital stay as one of the methods of measuring the efficacy of treatment. The mean duration of stay in the hospital in this study population was 31.31 days. In patients who required intra oral reconstruction, the group who under went primary closure had the least mean duration of stay, i.e. 28 days. There was no significant statistical difference between the various loco-regional flaps used as far as the duration of stay was concerned [21]. With reconstruction of extra oral defect the minimal period of stay was 29 days in 38.58% of patient in whom no reconstruction was required. The highest period of stay was found to be for those who required a deltopectoral flap for reconstruction [25]. This can be explained by the fact that with this methods an additional procedure was required, i.e. returning of the flap after 3 weeks. The duration of the stay in these cases of deltopectoral flap was significantly higher when compared to no reconstruction or PMMC [21].

In a short period of 1-year follow up, four patients, i.e. 3% expired. A recurrence rate of 11% was found [7, 20]. Considering the fact that 80% of the patients had stage IV disease or presentation. These results are highly satisfactory. However, the obvious limitation of the article is its retrospective nature and the attendant difficulties in the collection of data.

Summary and Conclusion

This study is a record based, retrospective analysis of all the cases of histologically proven squamous cell carcinoma of the oral cavity for which wide excision of the lesion along with segmental mandibulectomy or hemimandibulectomy and primary reconstruction with local or regional flaps was the treatment modality, with 1-year follow up after the management.

A total of 127 patients formed the study group. In the absence of bone reconstruction PMMC still continues to be the “work horse” of reconstruction following wide excision and hemimandibulectomy. As most of the patients were at stage IV, recurrence of the disease was usually high. The hospital stay is considered minimal for the given condition with the use of PMMC flap but the complication rate was high. A higher rate of complication did not increase over all hospital stay when compared to other methods of reconstruction barring primary closure.

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