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Definitive maxillary obturator prosthesis: Timelines for fabrication and follow-up

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Abstract

Introduction: A definitive maxillary obturator prosthesis can be used to rehabilitate a maxillary defect with the aim of improving speech, deglutition, and elimination of oronasal regurgitation. The aims of this study were (1) to determine the time required to fabricate a definitive maxillary obturator prosthesis and (2) to compare the fabrication and follow-up times between a patient's first and second definitive maxillary obturator prosthesis.

Materials and methods: A retrospective review was completed of patients that had maxillary definitive obturators fabricated following head and neck surgery from 2002 to 2018 ($n = 173$). Demographics, clinical data, date of surgery, start date of fabrication, follow-up dates, and prosthesis follow-up data were collected.

Results: The median time to delivery of the patient's first definitive maxillary obturator prosthesis from the date of surgery was 7.7 months for nonradiated patients and 9.6 months for radiated patients ($P \leq .05$). Additionally, there was a significant difference in the median number of appointments to fabricate the 1st definitive maxillary obturator prosthesis as compared to the 2nd prosthesis (6 vs 5; $P \leq .05$).

Conclusion: Fabrication timelines differed based on history of radiotherapy and patient experience. This data is helpful to set expectations for patients and practitioners regarding the process for prosthesis fabrication and follow-up.

Keywords

fabrication; maxillary defect; maxillary obturator prosthesis; maxillectomy; oral cancer; rehabilitation

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

1 INTRODUCTION

Maxillary defects of congenital, traumatic, or oncologic origin can be rehabilitated through the use of a maxillary obturator prosthesis. This prosthesis replaces the missing structures of the maxilla, occludes oro-antral communications, prevents oronasal regurgitation, and assists the patient in deglutition and speech production. Long-term success of the maxillary obturator prosthesis can be impacted by patient overall health-related factors (such as comorbidities or disease recurrence) as well as anatomical factors such as defect size, the presence or absence of scar tissue, or dentition status.[1,2]

The maxillary obturator prosthesis has been reported as a potential solution for rehabilitation of maxillary defects as early as the 16th century, during which time Ambroise Pare popularized the treatment concept.[3] The early prostheses were used to treat congenital defects but were later applied to both congenital and acquired defects of the maxilla.[4] As the treatment concept has evolved, it has been suggested that maxillary obturation for acquired defects should occur in three distinct phases: surgical, interim, and definitive.[5,6] The surgical maxillary obturator prosthesis is inserted during the surgery and acts as a matrix to hold surgical packing. The interim maxillary obturator prosthesis, usually placed approximately 1 week following surgery, is removable and can be adjusted during the postoperative healing period. Once the maxillary defect has become dimensionally stable, which may occur 3–4 months postsurgery, a definitive maxillary obturator prosthesis can be fabricated.

Prior to beginning fabrication of the definitive maxillary obturator prosthesis, it is advisable for the practitioner to assess the effort required to complete the prosthesis to manage patient expectations as well as effectively plan the process for completion. Multiple algorithms have been suggested for preoperative defects[7–10] and patient assessment[11–13]; however, it is ultimately the practitioner's discussion with the patient that sets the expectations for future interactions. Additionally, it has been suggested that a patient's previous experience with a prosthesis can be used as a predictor for future prosthetic success.[14] Unfortunately, as it relates to definitive maxillary obturator prostheses, there is paucity of information identifying the effort required to fabricate such a prosthesis and the expected follow-up following prosthesis delivery. Moreover, there is no information available describing the difference in first definitive maxillary obturator prosthesis and second definitive maxillary obturator prosthesis effort and follow-up. As a result, the purpose of this study was (1) to determine the time required by the practitioner to fabricate and follow-up a patient's first definitive maxillary obturator prosthesis and (2) to compare the time for fabrication and follow-up between a patient's first and second definitive maxillary obturator prosthesis.

2 MATERIALS AND METHODS

A retrospective review (IRB# 16–1132) was completed of definitive maxillary obturator prostheses fabricated at a tertiary cancer center following head and neck surgery from 2002 to 2018. Patients who underwent primary surgery at Memorial Sloan Kettering Cancer Center (MSKCC) and had their definitive maxillary obturator prosthesis fabricated by the MSKCC Dental Service were included in the study cohort. Patients with incomplete

chart data were excluded from the study. Patient records were reviewed to obtain patient demographics, tumor data, and treatment data.

Wilcoxon rank sum tests were used to compare time from surgery until start of fabrication of the prosthesis, time from fabrication of the prosthesis until its delivery, and time from surgery until delivery of the prosthesis between the radiated and nonradiated patients and by tumor stage. Wilcoxon signed rank tests were used to compare the number of follow-up appointments in each 30-day interval during the first 90 days (0–30, 31–60, and 61–90). Wilcoxon signed rank tests were also used to compare the number of follow-up appointments, as well as to compare time from surgery until start of fabrication between patients' 1st prosthesis and 2nd prosthesis. Overall prosthesis lifetime was calculated as time from definitive obturator delivery date until date of mechanical failure or patient's last dental follow-up for that prosthesis. All statistical analyses were obtained by using R Statistical Software version 3.5.2 (R Foundation for Statistical Computing; Vienna, Austria).

3 RESULTS

During the 16-year study period, 173 patients met our inclusion criteria. The median age of the patients at the time of surgery was 62 years (range 13–89 years). Patient demographics are presented in Table 1. The time required to fabricate the patient's first definitive maxillary obturator prosthesis is presented in Table 2. The median number of appointments required to fabricate the definitive maxillary obturator prostheses for the patients with T1 and T2 defects compared to T3 and T4 defects[15] was the same (median = 5 for both, $P \leq .87$). The number of follow-up appointments required postdelivery of the first definitive maxillary obturator prosthesis calculated in 30-day intervals as well as overall follow-up is presented in Table 3. There was a significant difference in the frequency of appointments: 0–30 and 31–60 days ($P \leq .05$); 31–60 and 61–90 days ($P \leq .05$); and 0–30 and 61–90 days ($P \leq .05$). The median follow-up for 1st prostheses without failure was 40 months (range 0–190 months).

Of the 173 included patients 42 patients had both a first and second definitive maxillary obturator prostheses fabricated by the MSKCC Dental Service. For this cohort, the median number of appointments required to fabricate the 1st definitive maxillary obturator prosthesis was 6 visits (range 3–17) and 2nd definitive maxillary obturator prosthesis was 5 visits (range 1–10) ($P \leq .05$). The median time to fabricate both the 1st and 2nd definitive maxillary obturator prosthesis was 2 months. The 90-day postdelivery follow-up for this cohort is presented in Table 4. The median follow-up for the 1st prostheses was 34.5 months (range 4–131) and for the 2nd prostheses was 31.2 months (range 0–127).

4 DISCUSSION

Information regarding the course of care can be valuable in setting expectations for both patients and providers. In maxillofacial prosthetics, such information has been sparsely available and as a result it can be challenging to educate patients, students, and colleagues on the efforts required to proceed with maxillofacial prosthetic fabrication. Historically, information regarding the efforts for definitive maxillary obturator prosthesis fabrication has been largely anecdotal with reports centering around personal experience. This study

presents data from 173 patient treatments, which is the largest cohort known to the authors to date.

The maxillary defects in this cohort are mostly of malignant etiologies (90%) which is expected as the treatments were completed at a cancer center. Additionally, most patients had defects that were the result of either T1 or T2 tumors (83%). T stage, a component of the American Joint Commission on Cancer (AJCC) staging system, is a method for describing the primary tumor size. Tumors of higher T stage are tumors of larger volume (T4 is the largest). Additionally, higher T stage tumors may also be associated with metastatic disease which eliminates the utility of surgical management. This was reinforced in our dataset as only 5% of patients had nodal disease. At our cancer center tumors of higher T stage are often surgically reconstructed following ablative surgery; however, there was no significant difference in this cohort in the number of appointments to fabricate the definitive maxillary obturator prosthesis when the data was stratified by T stage.

Radiotherapy to the head and neck may cause acute and chronic treatment-related toxicities (ie, mucositis, xerostomia, fatigue) that can result in delayed prosthesis fabrication.[16] This was supported by our findings that radiated patients began prosthesis fabrication significantly later than nonradiated patients (5 months vs 7 months). It was also found that once patients proceeded with definitive maxillary obturator prosthesis fabrication there was no significant difference in treatment time (median 2 months for both radiated and nonradiated patients). This information is useful in educating patients and interdisciplinary colleagues on the likely course of care and the impact of adjuvant therapy on overall treatment time.

Following delivery of the maxillary obturator prosthesis, the median postdelivery follow-up during the first 90 days was 2 follow-up appointments. When evaluated in 30-day intervals there were a median of zero follow-up visits during days 61–90. The fabrication process for the 2nd definitive maxillary obturator prosthesis was also shorter than the timeline for fabricating the 1st definitive maxillary obturator prosthesis. Treatment timelines may be impacted due to multiple patient and provider factors, including disease status, patient ability to accommodate to the prosthesis, patient familiarity with the fabrication procedure, provider skill/capacity, or the provider’s ability to address patient concerns regarding the prosthesis. Prior to proceeding with definitive maxillary obturator prosthesis fabrication, the patients in this cohort were without evidence of maxillary disease/had stable maxillary disease and had successfully been functioning with an interim maxillary obturator prosthesis. The definitive maxillary obturator prostheses at our center are conventionally made of chromium-cobalt frameworks with polymethylmethacrylate for dentate patients which are not as easily adjustable as the polymethylmethacrylate prostheses used during the interim phase of care. By waiting until patients have accommodated to the interim prosthesis prior to proceeding to a definitive prosthesis with a rigid metallic framework, a provider can maximize the opportunity for prosthetic success and patient accommodation in the definitive phase of care. Patients that proceed with fabrication of a definitive prosthesis prior to accommodation to an interim maxillary obturator prosthesis may experience different and possibly prolonged fabrication and follow-up timelines for definitive prosthetic care.

Many factors can impact the mechanics of a maxillary obturator prosthesis that can result in prosthetic failure. Defects of larger size or defect configurations that result in compromised prosthetic stability, retention, and support may not present clinical situations that are suitable for prosthetic success. Additionally, if the maxillary defect has poor overlying tissue quality, such that the residual gingiva or mucosa is friable or easily irritated, poor patient outcome can be anticipated. Moreover, remaining tooth arrangement and opposing occlusal schemes can create challenges for prosthesis retention or prosthetic dislodging forces from the opposing dentition.

For patients that have challenges accommodating to their prosthetics, practitioners can modify the retentive mechanisms through use of resilient attachments or dental implant retention mechanisms wherever possible. Although previous studies have demonstrated the benefit to prosthetic rehabilitation for maxillary defects as it relates to patient quality of life and function following maxillectomy due to tumor ablation[17,18] there is a paucity of data regarding the role of maxillary obturator attachment design on health-related quality of life outcomes.

There were multiple limitations of this study. First, as this was a retrospective study, data was limited to information available in patient records. Future prospective studies to evaluate definitive maxillary obturator design options, prosthesis retentive mechanisms, and health-related quality of life measures as it relates to prosthesis design is an area of future research. Additionally, the patient cohort in this study was from a single tertiary cancer center. Prospective data from multiple centers, inclusive of patients with variable maxillofacial defect etiologies including defects of traumatic or congenital origin, would aid in determining the generalizability of the results. Additionally, many patients return to their local dentists for routine follow-up and do not continue follow-up at the MSKCC Dental Service. As a result, the ability model true long-term prosthesis survival rate remains as an opportunity for future research in collaboration with local providers. Moreover, future studies can incorporate patient-reported outcome data, including patient quality of life data, to better understand the patient experience during fabrication and utilization of definitive maxillary obturator prostheses.

5 CONCLUSION

Definitive maxillary obturator prosthesis fabrication timelines differed based on history of radiotherapy as well as previous patient experience with the prosthesis. This data is helpful to set expectations for patients and practitioners regarding the process for prosthesis fabrication and follow-up.

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TABLE 1

Patient demographics

Variables		***n*** **= 173 (%)**
Gender	Male	86 (50)
	Female	87 (50)
Area of residence	Tri-state area	146 (84)
	Outside tri-state area	27 (16)
Pathology	Adenoid cystic carcinoma	35 (20)
	Basal Cell carcinoma	1 (0.5)
	Benign Lesions	17 (10)
	Melanoma	4 (2)
	Metastatic esthesioneuroblastoma	1 (0.5)
	Mucoepidermoid carcinoma	8 (5)
	Myoepithelial carcinoma	2 (1)
	Sarcoma	10 (6)
	Squamous cell carcinoma	90 (52)
	Verrucous carcinoma	5 (3)
Tumor location	Base of skull	1 (0.5)
	Maxillary gingiva	48 (28)
	Maxillary sinus	19 (11)
	Nasal cavity	7 (4)
	Overlapping sites of maxilla	93 (54)
	Pterygopalatine fossa	1 (0.5)
	Tonsil	4 (2)
Clinical T stage	T1/T2	144 (83)
	T3/T4	29 (17)
Clinical N stage	N0	165 (95)
	N1/N2	8 (5)
Postoperative radiation therapy	Yes	92 (53)
	No	81 (47)
Postoperative chemotherapy	Yes	140 (81)
	No	33 (19)
Dentition status	Dentate	146 (84)
	Edentulous	27 (16)

TABLE 2

Time required for the delivery of the 1st definitive maxillary obturator prosthesis comparison between radiated and nonradiated patients

	(*n*= 173)		Postoperative radiation (*n*= 96)		No radiation (*n*= 71)		
	Median (months)	**Range**	**Median (months)**	**Range**	**Median (months)**	**Range**	***P*-value**
Time from date of surgery until start of fabrication of the prosthesis	6	0–62	7	0–62	5	1–59	≤.05
Time from start of fabrication of the prosthesis until its delivery	2	0–10	2	0–7	2	0–10	.55
Time from date of surgery until delivery of the prosthesis	8	1–67	9	1–65	7	2–67	≤.05

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TABLE 3

Number of follow-ups postdelivery of the 1st definitive maxillary obturator prosthesis

Definitive maxillary obturator prosthesis follow-up (30-day intervals)	*N* = 173	
	Median	Range
0–30 days	1	0–6
31–60 days	1	0–7
61–90 days	0	0–5
0–90 days	2	0–15

TABLE 4

Comparison of follow-up required following delivery of the definitive maxillary obturator prosthesis

Definitive maxillary obturator prosthesis follow-up visits (30-day intervals)	1st prosthesis (*n*= 42)		2nd prosthesis (*n*= 42)		
	Median	Range	Median	Range	*P*-value
0–30 days	2	0–4	1	0–4	.12
31–60 days	1	0–4	0	0–3	.15
61–90 days	1	0–3	0	0–2	.18
0–90 days	3	0–10	2	0–8	≤.05