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Original Article

Oral-Health Related Quality of Life of Implant Supported Obturator Prosthesis versus Conventional Obturator in Hemi-maxillectomy Patients

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Abstract

Aim: The aim of this study was to compare implant-supported obturator prostheses and conventional obturator regarding oral health-related quality of life (OHRQoL) in partially edentulous hemimaxillectomy patients.

Material and methods: Sixteen patients having multiple teeth loss in the intact portion of the remaining alveolar ridge after maxillary resection were selected and divided into two equal groups. For group I: participants received implant supported obturator prosthesis while for group II: participants received conventional obturator. Using the Functional Obturator Scale scores oral health-related quality of life was evaluated at baseline and after six months of obturator use. Statistics were done using Mann Whitney test and Kruskal Wallis test to compare the oral health impact profile scale in both groups.

Results: The study presented that at baseline there was statistically insignificant difference between the two groups. At six months, group I was significantly better than group II regarding chewing limitation and speech limitation but there was statistically insignificant difference between the two groups regarding esthetic limitation, social disability and functional limitation

Conclusions: It was concluded that implant supported obturator prosthesis can improve the oral health-related quality of life of hemimaxillectomy patients through improving chewing and speech ability.

Keywords: Oral health impact profile, conventional obturator, implant supported obturator, maxillofacial patients, quality of life.

I. INTRODUCTION

Maxillofacial defects are recognized as one of the most distressing conditions, arising from causes such as trauma, burns, tumors, infection, or congenital malformations.(Leoncini *et al.*, 2014) Complications following tumor resection surgeries involving the mandible or maxilla can lead to various abnormalities that impact speech, swallowing, mastication and esthetics. These complications can arise due to the extensive nature of the surgery, involvement of critical structures in the head and neck region, adjuvant therapies or unsuccessful reconstruction surgeries following tumor removal.(Chigurupati *et al.*, 2013)·(Rogers *et al.*, 2003)

Management of these complications often requires a multidisciplinary approach involving oral and maxillofacial surgeons, prosthodontists, otolaryngologists, speech therapists, and other healthcare professionals. Rehabilitation strategies may include dental prostheses, speech therapy, swallow rehabilitation, and surgical revision as needed to optimize functional outcomes and quality of life for patients.(Kumar *et al.*, 2013)·('scholar (2)', no date)

Given the challenge of restoring complex defects using surgical techniques as well as the need for post-surgical oncological surveillance of highly recurrent tumors, prosthodontic rehabilitation plays a crucial role in addressing such defects. This therapy involves various aspects such as replacing missing teeth, providing facial support, ensuring oronasal separation, improving phonation and deglutition and boosting self-esteem. These interventions collectively contribute to significantly enhancing the quality of life for patients.(Kornblith *et al.*, 1996)·(Leoncini *et al.*, 2014)

Combating maxillofacial tumors often necessitates adjuvant therapy encompassing radio and/or chemotherapy. When coupled with neglected oral hygiene, aged dental restorations, and overloaded abutments supporting obturator prostheses, these factors collectively place the remaining healthy teeth of the resected arches at high risk of caries, mobility and loss.(Controversies and Oral, 2006; Artopoulou *et al.*, 2022) Eventually compromising the obturator prosthesis functionality and oronasal competence especially in hemimaxillectomy cases where stability and retention are mainly provided by teeth on the intact side of the arch, defect size, tissue undercuts available around the cavity and development of muscular control.(Peker, 2017)·('Clinical Oral Implants Res - 2020 - Buurman - Masticatory performance and oral health-related quality of life in edentulous.pdf', no date)

Despite the lower reported survival and success rates of dental implants in maxillofacial cases compared to implants in conventional sites, this treatment has become widely accepted as a viable option in addressing oral and maxillofacial deformities·(Lodders *et al.*, 2022)·(Mertens *et al.*, 2016)

Meanwhile, it is well recognized that dental implants contribute to enhanced patient satisfaction and quality of life. They offer improved retention and stability, enhanced chewing function, and have the potential to preserve substantial bone. The overall survival rate for implants supporting maxillofacial prostheses has been reported to be as high as

96.1%.(Shrestha *et al.*, 2020)،(Ackermann *et al.*, 2020) Concerns related to financial limitations and various risk factors such as tumor recurrence, radiation-induced osteoradionecrosis, bone quantity and quality, and load distribution can negatively impact implant survival.

Consequently, in cases involving partially edentulous quadrants of resected maxillary arches, prioritizing the rehabilitation of maxillofacial defects using a conventional obturator prosthesis in some instances, may be necessary.(Shah, Chauhan and Solanki, 2017)،(Depprich *et al.*, 2011)،(Niakan *et al.*, 2024)

The effectiveness of an obturator prosthesis can be evaluated through both objective and subjective methods. Objective assessment involves using advanced scientific instruments and techniques by the operator.(Kumar *et al.*, 2013)،('scholar (1)', no date) Subjective assessment, on the other hand, involves evaluating the prosthesis from the patient's perspective.

One commonly utilized tool for assessing quality of life (QOL) is the Obturator Functioning Scale (OFS), which provides a subjective estimation of HRQOL(Fayad, Atito and Ammar, 2019)،(Abdelfattah Mohamed and kothayer, 2020) . Clinical observations indicate that the quality of life (QOL) of these patients may be impacted by several factors. These include the type and stage of the tumor, medical conditions present alongside, the size of the surgical defect, duration of disability, adjuvant therapy, state of remaining maxillary teeth, method of reconstruction, efficiency of prosthetic restoration, as well as demographic and social factors.(Artopoulou *et al.*, 2022)،(Ali, Khalifa and Alhajj, 2018)،('scholar', no date)

Unfortunately, there is a lack of literature reporting on oral health-related quality of life (OHRQOL) following the rehabilitation of hemi-maxillectomy patients using conventional and implant-supported obturators. Thus, the aim of this study was to compare implant-supported obturator prostheses and conventional obturator regarding oral health-related quality of life (OHRQOL) in partially edentulous hemimaxillectomy patients.

II. MATERIALS AND METHODS

Sixteen patients (6 males and 10 females) age range from 30-65 years old having maxillary defects were selected from the Maxillofacial unit (F.G.), Faculty of Dentistry, ENT Department, Cairo University or the National Cancer Institute. To determine the appropriate sample size, the T test power calculation was utilized. The findings indicated that 16 patients overall would be a sufficient sample size to achieve an 80% power.

This controlled clinical study protocol was approved by Research Ethics Committee of Faculty of Dentistry, Cairo University (FDCUREC). Every patient received comprehensive information regarding the purpose and nature of the investigation. An informed consent form was signed by them.

Following a predetermined set of inclusion and exclusion criteria, participants with hemimaxillary defects were accepted into the study if they met the criteria of having three or more missing teeth in the intact sites of the remaining alveolar ridge, and had no systemic conditions that could impact implant osseointegration.

The remaining maxillary teeth were required to be in good condition, or restored if needed. Individuals undergoing chemotherapy at the time of recruitment were excluded from the study, while those who had undergone previous adjuvant therapy needed to have completed their treatment at least 2-4 months prior to initiation of implant therapy.

fabricated radiographic stent. Based on the size of the final drill, the corresponding implant (Dentium, Superline 2, Korea) was inserted manually using the implant mount and ratchet with acceptable primary stability. All patients received 2-3 neighboring implants according to the size of edentulous span that were positioned 0.5 mm subcrestally and at least 3mm apart. (figure 1a, b)

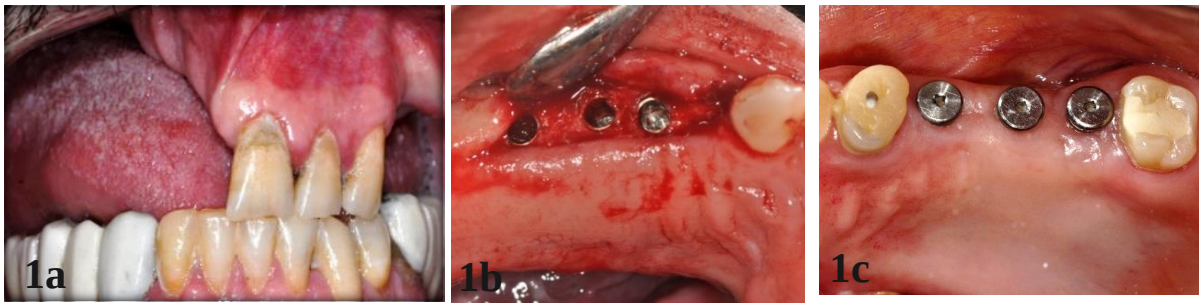

Figure (1): a. Intra oral frontal view of hemimaxillectomy patient showing the surgical defect, b.Occlusal view of the 3 implants finally inserted in osteotomies, c. Soft tissue healing around implant healing abutments.

For all participants, a radiographic stent made of radio-opaque material was fabricated and utilized for cone beam computed tomography (CBCT) imaging for implant planning purposes. Patients with sufficient residual alveolar ridge for standard implant placement were assigned to Group I and received an implant-supported obturator. Conversely, those who did not meet the requirements for implant placement received a conventional metallic framework obturator and were assigned to Group II.

Group I (intervention group)

Blue Sky Bio implant planning software was used to assess the implant site buccolingually and occluso-gingvally. Surgical flaps were created with the intended number of implants and the implantation site. Implant drilling was done guided with the previously

The second stage surgery was performed after 6 months. After the implants were checked for clinical success they were exposed and gingival formers were placed. (figure 1c) Clinical and laboratory steps were carried out for the fabrication of implant retained tissue bar. Using irreversible hydrocolloid impression material (Cavex, Holland BV), preliminary impressions for the maxillary and mandibular arches were done. Aided by a dental surveyor (Bio-Arts Surveyor model B2, Brazil), the maxillary cast was surveyed for determining the path of insertion and abutment teeth preparations.

The final impression was made using a customized tray and medium consistency silicone impression material (Elite HD+ Monophase Medium Body Zhermack, Italy) utilizing the splinted open tray impression technique after executing the planned mouth

preparations, which included rest seats, guiding planes, and surveyed crowns. (figure 2a)

Vaseline gauze was used to block areas of undesirable soft and bony undercuts. On the mounted casts, the acrylic teeth were arranged and a putty index was made to analyze the prosthetic space available for determining the type of attachment. Accordingly, micro sized ball attachments over bar splints were used in bounded cases while OT Cap (saddle design) (Rhein 38, Italy) was used in free end saddle cases. (figure 2b) Plastic burnout implant abutments on titanium bases were used for the construction of cobalt chromium bars and attachments. After which, the metal framework was constructed and the finished obturator was delivered using the direct pickup technique. (figure 2c, d)

workflow for RPD construction. Irreversible hydrocolloid impression material was used to make diagnostic casts for both arches on which surveying and RPD framework design were carried out. After finalizing the planned mouth preparations which included rests seats, guiding plans, surveyed crowns and recontouring axial walls, a customized maxillary tray (Acrostone, cold cure special tray material, Cairo, Egypt) was fabricated for recording the definitive impression using rubber base impression material (Zhermack, Zetaplus & Oranwash VL, Badia Polesine RO, Italy). The RPD framework wax pattern was built up on the refractory cast and the cast metal framework was checked intraorally. Following the recording of the centric relation using the check-bite technique, artificial teeth were arranged and the prosthesis was processed and finished. (figure 3)

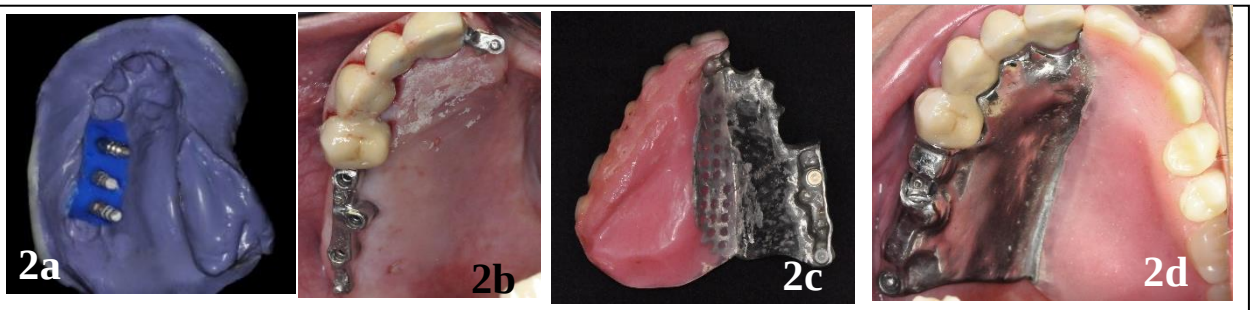

Figure (2): a. Final impression after attaching the implant laboratory analogous and applying the tissue mimic. b. The screwed cobalt chromium bar intraorally, c. The fitting surface of the obturator with attached clips, d. Occlusal view showing the implant supported obturator intraorally

Group II (control group)

This group involved patients who are not eligible for implant placement and received a conventional metallic framework obturator which employed the traditiontal fabrication

Finally, prosthesis fit, borders and extensions were checked clinically using pressure indicating paste and pressure areas were relieved, finished and polished. All patient received instructions regarding prosthesis insertion, removal, and maintenance as well as specific instructions for daily oral hygiene,

which included cleaning their prosthesis and brushing their teeth with a soft toothbrush.

The Obturator Functioning Scale (OFS) was established by Memorial Sloan Kettering Cancer Center (New York, NY, USA)(Kornblith *et al.*, 1996) to assess health-related quality of life (table.1.). It was intended to assess speaking, eating ability, appearance, social interaction, and functional satisfaction. The 15 items were rated on a 5-point Likert scale: "not at all," "a little difficult," "somewhat difficult," "very difficult," and "extremely difficult."

Two certified translators translated the Obturator Functioning Scale into Arabic, and two additional certified translators translated it back into English. Subsequently, ten multilingual volunteers were provided with both the English and Arabic versions alternately for assessment. For post-insertion follow-up and completion of the quality-of-life questionnaire, all patients were scheduled for recall appointments at one week then monthly after receiving the final prostheses.

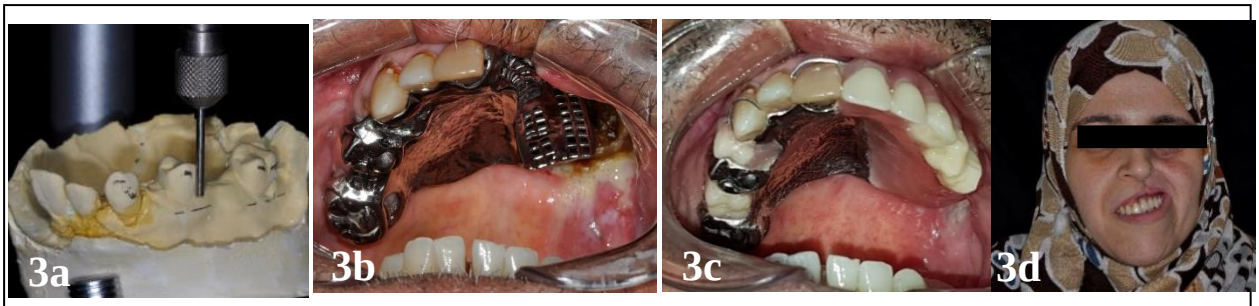

Figure (3): a. Surveying of the master cast, b. Try in of metallic framework, c. Finished conventional obturator intraorally, d.Frontal view of the patient after delivery of the conventional obturator

Table 1: Functional Obturator Scale

Functional Obturator Scale		Not at all difficult' 1	'A little difficult' 2	'Somewhat difficult', 3	'Very much difficult' 4	'Extremely difficult. 5
Chewing Limitation	Difficulty in chewing					
	Leakage when swallowing foods					
	Mouth feels dry					
Speech Limitation	Voice different from before surgery					
	Difficulty talking in public					
	Speech is nasal					
	Difficulty pronouncing words					
	Speech is difficult to understand					
	Difficulty talking on the phone					
Esthetic Limitation	Dissatisfaction with looks					
	Clasp on front teeth noticeable					
	Upper lip looks funny					
Social Disability	Avoidance of family or social events					
Functional Limitation	Difficulty to insert or remove obturator					
	Any area feels numb					

III. RESULTS

Data was collected, tabulated and statistically analyzed using SPSS (Statistical package for the social sciences) version 20, IBM corp., U.S.A. Exploration of the given data was performed using Shapiro-Wilk test and Kolmogorov-Smirnov test for normality. As the data was non-parametric, intergroup comparison (comparison between groups) was performed by using the Mann Whitney test, while intragroup comparison (comparison between baseline and after 6 months) was performed by using Kruskal Wallis test.

Intergroup comparison:

At baseline, there was insignificant difference between groups regarding Chewing limitation, Speech limitation, Esthetic limitation, Social disability and functional limitation, at P-value <0.05 as presented in table (2) and figure (4).

After 6 months, regarding chewing limitation, group 1 (1.13 ± 0.23) was significantly better than group 2 (2.25 ± 1) as P=0.02. while for speech limitation, group 1 (1.15 ± 0.39) was significantly better than group 2 (2.31 ± 0.86) as P=0.05. Regarding esthetic limitation, social disability and functional limitation there were insignificant difference between the two groups.

Table (2): Intergroup comparison to evaluate effect of treatment

			Range	Median	Mean	Standard Deviation	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		Sig. (2-tailed)
									Lower	Upper	
Baseline	chewing limitation	Group 1	1.00	2.05	2.19	.34	-0.19	0.15	-0.50	0.13	0.160
		Group 2	.60	2.50	2.38	.24					
	speech limitation	Group 1	1.86	2.15	2.17	.63	-0.17	0.36	-0.94	0.60	0.380
		Group 2	2.15	2.50	2.33	.80					
	esthetic limitation	Group 1	1.67	1.67	1.75	.64	-0.44	0.40	-1.29	0.42	0.230
		Group 2	2.34	1.80	2.19	.93					
	social disability	Group 1	2.00	2.00	2.02	.73	0.40	0.36	-0.37	1.17	0.160
		Group 2	1.90	1.53	1.62	.70					
	functional limitation	Group 1	2.00	2.00	2.02	.76	-0.22	0.30	-0.86	0.42	0.510
		Group 2	1.00	2.45	2.24	.37					
After 6 months	chewing limitation	Group 1	.50	1.00	1.13	.23	-1.13	0.36	-1.90	-0.35	0.020*
		Group 2	2.50	2.00	2.25	1.00					
	speech limitation	Group 1	1.00	1.57	1.45	.39	-0.86	0.33	-1.58	-0.14	0.050*
		Group 2	2.14	2.58	2.31	.86					
	esthetic limitation	Group 1	2.00	1.67	1.71	.65	-0.58	0.40	-1.45	0.28	0.190
		Group 2	2.33	2.50	2.29	.93					
	social disability	Group 1	1.00	1.00	1.28	.45	-0.34	0.29	-0.97	0.29	0.320
		Group 2	2.00	1.45	1.61	.70					
	functional limitation	Group 1	1.50	1.55	1.58	.61	-0.34	0.31	-1.00	0.31	0.320
		Group 2	1.67	2.00	1.92	.61					

: *Significant difference as P<0.05

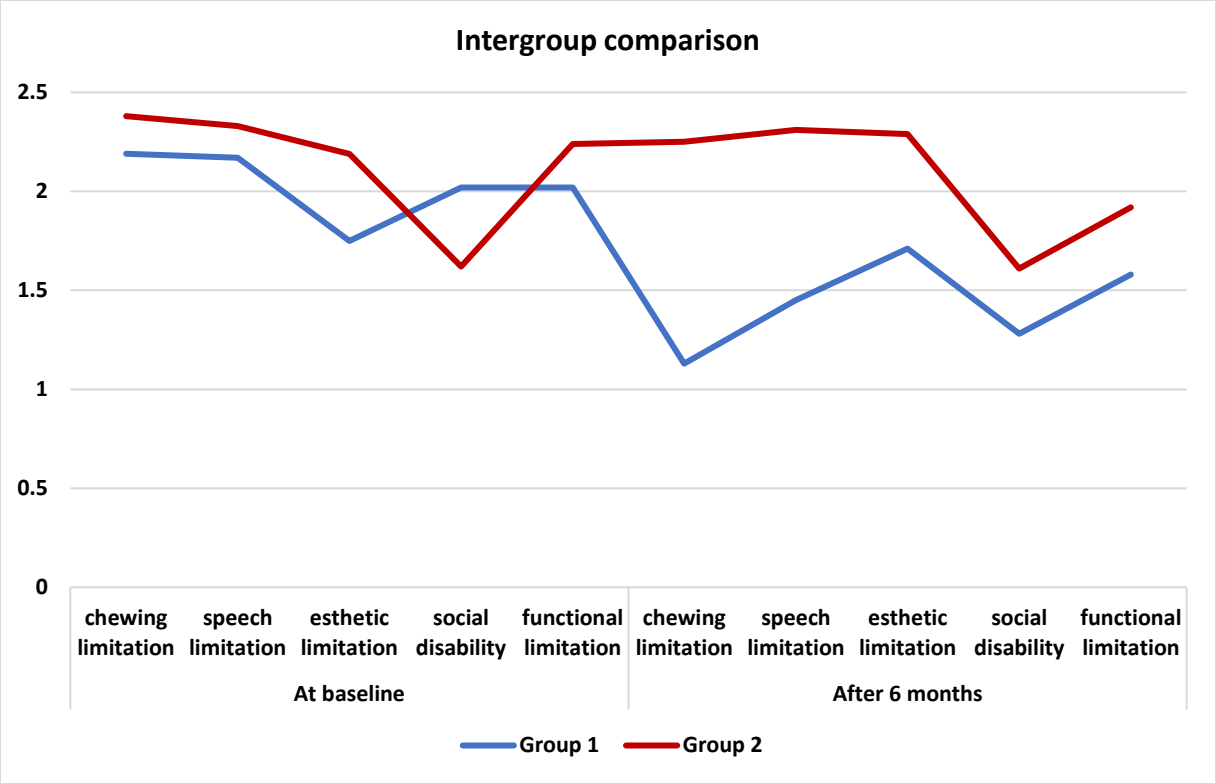

Figure (4): bar chart showing comparison between group 1&2 to evaluate effect of treatment at baseline, and after 6 month

Intragroup comparison (comparison between baseline and after 6 months):

In group 1, regarding chewing limitation there was significant improvement from (2.19 ± 0.73) at baseline to (1.13 ± 0.23) after 6 months as P=0.008. Regarding functional limitation, there was significant improvement from (2.01 ± 0.71) at baseline to (1.01 ± 0.04) after 6 months as P=0.02. Regarding Speech limitation, Esthetic limitation, and Social disability there were insignificant improvement as P-value <0.05 in all the three domains.

In group 2, regarding functional limitation, there was significant improvement from (2.24 ± 0.68) at baseline to (1.92 ± 0.61) after 6 months as P=0.03. But in Chewing limitation, Speech limitation, Esthetic limitation, and Social disability there were insignificant improvement as P-value <0.05 in all the four domains. (table 3)

Table (3): Intragroup comparison (comparison between baseline and after 6 months) to evaluate effect of time:

							Paired Differences					
			Range	Median	Mean	Standard Deviation	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		Sig. (2-tailed)
										Lower	Upper	
Group 1	chewing limitation	Baseline	1.00	2.05	2.19	0.34	-1.06	0.23	0.08	-1.25	-0.87	0.01*
		After 6 months	.50	1.00	1.13	0.23						
	speech limitation	Baseline	1.86	2.15	2.17	0.63	-0.72	0.84	0.30	-1.42	-0.02	0.04*
		After 6 months	1.00	1.57	1.45	0.39						
	esthetic limitation	Baseline	1.67	1.67	1.75	0.64	0.04	0.85	0.30	-0.66	0.75	0.75
		After 6 months	2.00	1.67	1.71	0.65						
	social disability	Baseline	2.00	2.00	2.02	0.73	0.74	0.68	0.24	0.18	1.31	0.02*
		After 6 months	1.00	1.00	1.28	0.45						
	functional limitation	Baseline	2.00	2.00	2.02	0.76	0.44	0.83	0.29	-0.25	1.13	0.14
		After 6 months	1.50	1.55	1.58	0.61						
Group 2	chewing limitation	Baseline	.60	2.50	2.38	0.24	0.13	1.03	0.36	-0.73	0.98	0.67
		After 6 months	2.50	2.00	2.25	1.00						
	speech limitation	Baseline	2.15	2.50	2.33	0.80	0.03	1.07	0.38	-0.87	0.92	0.99
		After 6 months	2.14	2.58	2.31	0.86						
	esthetic limitation	Baseline	2.34	1.80	2.19	0.93	-0.10	1.15	0.41	-1.07	0.86	0.77
		After 6 months	2.33	2.50	2.29	0.93						
	social disability	Baseline	1.90	1.53	1.62	0.70	0.01	0.45	0.16	-0.37	0.38	0.67
		After 6 months	2.00	1.45	1.61	0.70						
	functional limitation	Baseline	1.00	2.45	2.24	0.37	0.32	0.48	0.17	-0.08	0.72	0.12
		After 6 months	1.67	2.00	1.92	0.61						

IV. DISCUSSION

This study was carried out at the Faculty of Dentistry, Cairo University, recognized as a tertiary center offering extensive dental care for individuals who have undergone tumor ablation surgeries in the head and neck region within the country. The authors examined the quality of life (QoL) of partially edentulous hemimaxillectomy patients 6 months following the of use of metallic

framework obturator prosthesis with and without implants.

The obturator functional scale has been used by several studies mainly for assessing the impact of various factors including defect morphology, treatment modality, demographic data and others on the efficiency of conventional obturators. However, to the knowledge of the authors, the current study is the first to address the influence of restoring missing teeth on the intact side of hemimaxillectomy patients using bar retained dental implants on the obturator functionality in comparison to conventional metallic RPD framework design.

Assessing quality of life (QoL) presents challenges due to its multidimensional and subjective nature, which also evolves over time and circumstances. Research examining QoL in patients with head and neck tumors indicates that the most substantial changes typically occur within the initial year following diagnosis.

In this study, quality of life (QOL) questionnaires were completed by patients after ensuring that they had a clear understanding of each domain and had been effectively using the obturator for one week and then again at six months.

Wearing an obturator presents challenges that are believed to be subjected to a learning process. Regardless of the nature of the defect or the method used to secure the prosthesis, patients tend to adjust to its use gradually. However, issues such as leakage, maintenance, and the need for frequent adjustments can be difficult to address. Moreover, as the wound heals and tissues remodel, the stability of the prosthesis may diminish over time. This can lead to minor leaks and food particles entering the nasal cavity, exacerbating existing problems. Consequently, satisfaction among patients using obturators may decrease.

In the current study, the implementation of close follow-up appointments with frequent obturator relining and adjustments enabled patients to undergo pain-free insertion and removal procedures.

This methodology supports the study's findings, wherein the majority of patients in both groups reported statistically significant improvements in obturator functionality during the initial six months.

In the current study, all patients of both groups reported significant improvement in the chewing ability and diminished fluid leakage over time. This finding is attributed to the fact that our study population is limited to hemimaxillectomy cases with 50% of their hard palate intact and not including soft palatal defects. These results are in accordance with Irish, et al(Leoncini *et al.*, 2014) who correlated the pronounced reporting of chewing limitations in their study population to the size of the resected portion of the hard palate. Similarly, Ali et, al(Ali, Khalifa and Alhajj, 2018) reported diminished complains on chewing and fluid leakage among Sudanese respondents with partial or smaller maxillary defects.

Regarding aesthetic concerns, neither group showed statistically significant improvement overtime. Previous studies reported satisfactory reports on esthetics with few patients concerned with look of their upper lip.(Depprich *et al.*, 2011) In the early stages of recovery, wound healing and tissue remodeling may result in lateral retraction of the skin exposing greater amount of teeth.

Moreover, the utilization of gingivally approaching clasp arm on the nearest incisor to the defect is mandatory in class I cases regardless of implant restorations.

In this study, all principles of RPD framework design were fulfilled in both study groups to maximize support and stability gained from the remaining dentition and implant supported attachments. In the same context, it's important to note that surgical resection in hemimaxillectomy cases is typically performed using a facial approach, resulting in a facial scar. This scar can serve as a constant reminder and may contribute to negative thoughts about self-esteem. Given that our study population are predominantly females who are known to develop more depressive attitude in such conditions, these factors collectively support the lack of pronounced improvement in the aesthetic domain.(Peker, 2017)

Many maxillectomy patients with obturator prostheses tend to avoid public appearances and invitations for meals, primarily due to difficulties with speech intelligibility, leakage of fluids from the mouth or nose, or particles adhering to the obturator prosthesis. The correlation between good obturator function and improved quality of life has been previously documented in studies, and our findings are consistent with this observation. Incorporating an implant-retained bar splint to replace missing teeth plays a crucial role in enhancing obturator retention and stability.(Depprich *et al.*, 2011)

Previous research comparing implant-retained overdentures with conventional removable partial dentures (RPD) in non-cancer populations has shown statistically significant differences in prosthesis functionality, patient acceptance, and quality of life. Given the mechanical and physical challenges associated with hemimaxillectomy cases, opting for this approach whenever feasible is highly advisable. This assertion is supported by the findings of our comparison between both groups, where the majority of assessed domains exhibited statistically significant differences favoring the implant-retained group.

Various factors can influence how patients respond to quality of life questionnaires. However, due to the unique nature of the population in the current study, characterized by scarcity, unpredictability, and incomplete compliance, full control over certain variables that could directly impact their responses was not feasible. In future studies evaluating the quality of life of similar populations, it's imperative to consider various factors such as the duration of disability, social status, psychological well-being, general health, educational status, previous adjuvant therapy, and dental health prior to disability. These variables can provide valuable insights into the holistic understanding of quality of life outcomes in such populations.(Ali, Khalifa and Alhajj, 2018)

V. CONCLUSION

A well-designed obturator can enhance quality of life irrespective of the method of prosthesis retention. Furthermore, incorporating dental implants to restore missing teeth on the intact side of hemimaxillectomy cases can lead to improved responses to quality of life questionnaires through improving chewing and speech ability**.**

Conflict of Interest:

The authors declare no conflict of interest**.**

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Ethical approval

This study protocol was approved by the ethical committee of the faculty of dentistry- Cairo university on: 26-6-2023 with number 31.6.23

Data availability

The data supporting the findings of the study area available within the articleand its supplementary material. Raw data of this study are available from the corresponding author, upon reasonable request.

Authors contribution

All the authors discussed the results and contributed to the final manuscript.

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