

Assessment of the Impact of Prosthodontic Intervention on the Oral Health Related Quality of Life among Post COVID-19 Mucormycosis Affected Individuals in Central India

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ABSTRACT

Introduction: The currently prevalent Coronavirus Disease 2019 (COVID-19) pandemic has amounted to various co-morbid conditions amongst patients and mucormycosis has been one among them. A globally emerging disease, this requires aggressive surgical treatment that necessitates due prosthetic rehabilitation.

Aim: To assess the impact of prosthodontic intervention on the Oral Health Related Quality of Life (OHRQoL) through Oral Health Impact Profile 14 (OHIP-14) questionnaire in post COVID-19 mucormycosis affected individuals.

Materials and Methods: The following study was a questionnaire-based prospective interventional study. The study population included post COVID-19 mucormycosis affected individuals who sought prosthodontic therapy for rehabilitation from the month of

April 2021 to October 2021. The study instituted the questionnaire amongst 48 consenting participants. The OHIP-14 questionnaire was validated in their native languages and data was collected before and one month after prosthodontic intervention. Data was statistically analysed by the Wilcoxon signed-rank test.

Results: For all the individual questions, OHRQoL impact showed a significant decrease following prosthetic intervention (p-value <0.05). Total OHIP score also showed a significant decrease post-treatment (p-value=0.001).

Conclusion: Percentage improvement of OHRQoL ranging from 34.79-59.86% post prosthodontic intervention was observed. Thus, the impact of prosthodontic therapy among post COVID-19 mucormycosis affected individuals on the OHRQoL of the patient is positively significant.

Keywords: Coronavirus disease 2019, Obturator, Oral health impact profile-14, Rehabilitation

INTRODUCTION

Mucormycosis is one of the most enfeebling mycotic infections in the modern era. They are a class of angio-invasive fungal infections, origins of which can be traced to filamentous fungi belonging to the Mucoraceae family. After *Aspergillus*, Mucorales fungi are the most commonly debilitating pathogens in patients with haematological disorders or patients who have undergone an organ-transplant procedure [1,2]. Additionally, Mucorales infections are increasingly recorded in diabetes mellitus-affected individuals [3,4], after trauma or iatrogenic injury [5,6] and have been associated with outbreaks following natural disasters. The spores of mucormycetes are present in soil, animal excreta and air, which can either be inhaled or inoculated in exposed wounds. They harbour reservoirs in the upper respiratory tract commonly and disseminate to affect the orbit and maxillary bones predominantly. Hence, of all its pathogenic variants, the rhinocerebral variant is the most prevalent, amounting to an approximate 30-50% of all cases of mucormycosis [7,8].

Recently, the Indian subcontinent has witnessed a considerable rise in incidences of Mucormycosis among Coronavirus Disease 2019 (COVID-19) affected individuals [9], with an alarming rate of about 70 times than that of the rest of the world [10]. Coronavirus Disease 2019 patients present with considerable neutropenia and lymphocytopenia that provide an immunologically-suppressed breeding ground for the dissemination of mucormycotic fungi [11]. Additionally, an escalating prevalence of uncontrolled diabetes cases [4] and concomitantly increased use of corticosteroid drugs [12,13] as a palliative measure to mitigate the challenges of oxygen dearth during the COVID-19 pandemic, have supposedly contributed to the increased incidence of rhinocerebral mucormycosis. A study even claims that about 10-20% cases were attributed to burns of the mucous membrane, secondary to excess steam inhalation [14].

The treatment strategy usually instituted is antifungal therapy and radical dissection of all affected tissues, leading to defects of the maxillo-facial region that demand early prosthetic interventions [15,16]. These maxillofacial defects amount to various postsurgical hindrances such as difficulty in mastication, impaired speech and issues of nasal regurgitation that warrant due postsurgical care. Moreover, they leave a physiologically-debilitating and psychologically-impaired patient who needs to be socially, functionally and vocationally rehabilitated [17]. Fabrication of a well-retained and functionally comfortable prosthesis contributes to the well-being of the affected individuals [18].

This study aimed to highlight the impact of a prosthodontic intervention and to assess any demography related significant variability on the Oral Health Related Quality of Life (OHRQoL) index, through Oral Health Impact Profile 14 (OHIP-14) questionnaire, as a measure of the rehabilitative efforts taken towards post COVID-19 mucormycosis patients in Central India.

MATERIALS AND METHODS

The present study was a questionnaire-based prospective interventional study. The study was an institutional based study on post COVID-19 mucormycosis affected individuals. Before performing the study, due ethical clearance was obtained from the Institutional Ethical Committee (Ref no- IEC/05/04). All post COVID-19 mucormycosis affected individuals who sought prosthetic rehabilitation between the months of April 2021 to October 2021, willing to participate were included in the study.

Inclusion and Exclusion criteria: Patients were re-assessed with the questionnaire one month after delivery of prosthesis and patients whose follow-up was completed before November 2021 were included in the study. No specific exclusion criteria were formulated, but patients unwilling to participate were excluded.

Consented post COVID-19 mucormycosis affected individuals (n=52) whose prosthodontic rehabilitation was done at Department of Prosthodontics, Government Dental College and Hospital, Nagpur, Maharashtra, India, were approached to enroll as subjects in this study. Following 4 drop outs, a total of 48 subjects were successfully enrolled to the study. Data analysis and interpretation was completed by December 2021. Additionally, along with their relevant demographic information, intraoral findings and the type of surgery performed for debridement were noted for all the participants. Extent of the defect was categorised based on the Army's classification of maxillary defects [19].

Oral Health Impact Profile 14 (OHIP-14) Questionnaire

The OHIP-14 index was translated into Marathi by a bi-linguistic translator and verified by the forward-backward technique [20,21]. Corroboration of its easy-to-understand language was done amongst a group of 40 individuals (above 30 years of age). The questions were close ended with answers rated on a 5-point Likert scale from 0-4 i.e., 0-never, 1-sometimes, 2-occasionally, 3-fairly often and 4-very often/daily [Table/Fig-1].

S. No.	Questions	0	1	2	3	4
1	Problem in pronouncing words					
2	Altered sense of taste					
3	Difficulty in chewing					
4	Pain/aching					
5	Worry about dental problem					
6	Psychological discomfort					
7	Problem affecting the diet					
8	Interruption in meals					
9	Difficult to relax					
10	Feeling embarrassed					
11	Feeling irritable towards others					
12	Job related difficulties					
13	Least satisfied in life					
14	Functional inability					

[Table/Fig-1]: OHIP-14 questions used in this study. 0-never, 1-sometimes, 2-occasionally, 3-fairly often and 4-very often/daily

The subjects were asked to answer the validated questionnaire which was printed in the language of their choice. If any of the participants encountered any difficulty in comprehending the questions, they were explained without prompting towards any definite answer. Subjects were asked to answer the questionnaire before prosthodontic intervention and subsequently one month after the same. Data was tabulated and assessed for each question, the different domains of OHIP-14 (functional domain, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap) and separately for completely edentulous and partially edentulous individuals. Percentage decrease of the scores for different domains of OHIP-14 was done using the formula given below.

$$\text{Percentage decrease} = \frac{\text{Difference between pre - mean and post - mean}}{\text{pre mean}} \times 100$$

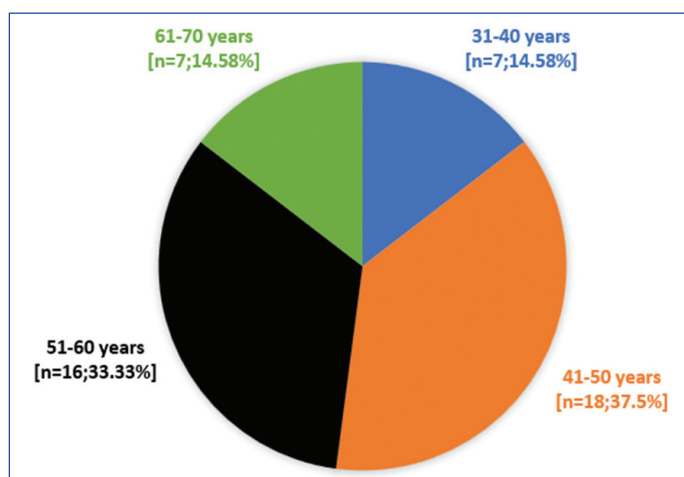
Through this data the effect of prosthodontic intervention on the OHRQoL was assessed.

STATISTICAL ANALYSIS

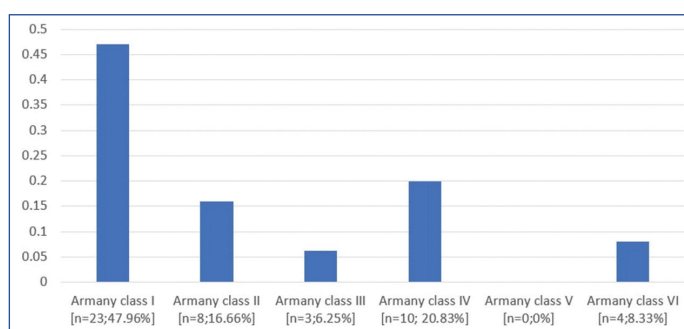
The data thus obtained, was subjected to statistical analysis by the Wilcoxon signed-rank test and the probability value was determined. Statistical Package for the Social Sciences (SPSS) version 20.0 software was used. Level of significance was kept at 5%.

RESULTS

On a demographic perspective, the mean age of 48 participants was 50.35 years (ranging from 34-67 year) [Table/Fig-2]. Of all the participants, majority were male subjects 41 (85.41%) and most of them presented with a history of diabetes mellitus 34 (70.83%). Among these patients there were 8 (16.66%) who were completely edentulous, while others were partially edentulous with some teeth worthy of providing retention and support to the prosthesis. Army class I defect was the most commonly occurring 23 (47.96%) and the least occurring type was Army class V defect (0) [Table/Fig-3]. Diabetes mellitus type II was noticed majorly 34 (70.88%) within the study population.



[Table/Fig-2]: Age distribution chart.



[Table/Fig-3]: Extent of defect distribution.

For each question, the mean was calculated both pretreatment and post-treatment, upon which the Wilcoxon-signed rank test was applied. The Probability value (p-value) was evaluated for each question and checked for significance [Table/Fig-4]. For all the individual questions, the OHRQoL impact showed a significant decrease following the treatment (p-value<0.05). Total OHIP score also showed a significant decrease post-treatment (p-value=0.001) [Table/Fig-4]. Additionally, under each domain of OHIP index, individual scores were estimated to assess the impact of prosthodontic intervention on the OHRQoL. The participants reported less OHRQoL impact scores, following treatment/intervention in all the domains that were statistically significant (p=0.001) [Table/Fig-5]. The percentage decrease of scores were assessed and the decrease ranged from 34.79-59.86% after prosthetic therapy. Separately, an assessment was made to check if there was any significant difference between completely edentulous and partially edentulous patients by the Wilcoxon signed rank test [Table/Fig-6,7]. Among completely edentulous patients, the OHRQoL impact showed a significant decrease following treatment (p-value <0.05). Total OHIP score also showed a significant decrease post-treatment (p-value ≤0.05), except for the question that addressed the sense of taste, which showed no significant change [Table/Fig-6]. Amongst partially edentulous patients, the OHRQoL impact showed a significant decrease following the treatment (p-value <0.05). Total OHIP score also showed a significant decrease post-treatment (p-value ≤0.001) [Table/Fig-7].

S. No.	Questions	Pretreatment Mean (SD)	Post-treatment Mean (SD)	p-value
1	Problem in pronouncing words	3.33 (0.808)	1.04 (0.874)	0.001*
2	Altered sense of taste	0.98 (0.863)	0.69 (0.657)	0.002*
3	Difficulty in chewing	3.40 (0.984)	1.85 (0.989)	0.001*
4	Pain/aching	2.15 (0.799)	1.15 (0.967)	0.001*
5	Worry about dental problem	2.71 (1.031)	1.60 (0.893)	0.001*
6	Psychological discomfort	1.52 (1.148)	0.96 (0.922)	0.001*
7	Problem affecting the diet	2.65 (1.062)	1.35 (1.082)	0.001*
8	Interruption in meals	3.50 (0.945)	1.42 (1.007)	0.001*
9	Difficult to relax	1.25 (1.229)	0.94 (0.976)	0.007*
10	Feeling embarrassed	2.40 (1.106)	0.92 (0.964)	0.001*
11	Feeling irritable towards others	1.27 (1.144)	0.79 (0.849)	0.001*
12	Job related difficulties	1.92 (1.182)	1.29 (0.874)	0.001*
13	Least satisfied in life	2.75 (1.120)	1.44 (1.128)	0.001*
14	Functional inability	2.00 (1.255)	1.04 (0.874)	0.001*
	Total	31.81 (3.890)	16.48 (3.707)	0.001*

[Table/Fig-4]: Comparison between OHRQoL (Pre-treatment) and OHRQoL (Post-treatment).

*Indicates significant difference at p-value ≤ 0.05 (Wilcoxon-signed rank test was used)

S. No.	Question	Pretreatment Mean (SD)	Post-treatment Mean (SD)	p-value
1.	Problem in pronouncing words	3.38 (0.758)	1.11 (0.906)	0.001*
2.	Altered sense of taste	0.89 (0.809)	0.68 (0.580)	0.011*
3.	Difficulty in chewing	3.32 (1.056)	1.78 (0.947)	0.001*
4.	Pain/aching	2.14 (0.855)	1.27 (0.99)	0.001*
5.	Worry about dental problem	2.62 (1.037)	1.65 (0.919)	0.001*
6.	Psychological discomfort	1.57 (1.168)	0.95 (0.911)	0.001*
7.	Problem affecting the diet	2.59 (1.066)	1.38 (1.139)	0.001*
8.	Interruption in meals	3.43 (1.015)	1.43 (0.959)	0.001*
9.	Difficult to relax	1.38 (1.299)	1.08 (1.01)	0.039*
10.	Feeling embarrassed	2.3 (1.151)	0.84 (0.958)	0.001*
11.	Feeling irritable towards others	1.24 (1.188)	0.78 (0.917)	0.001*
12.	Job related difficulties	1.84 (1.214)	1.3 (0.939)	0.001*
13.	Least satisfied in life	2.92 (1.01)	1.46 (1.1095)	0.001*
14.	Functional inability	1.89 (1.197)	1.03 (0.897)	0.001*
	Total	31.51 (3.82)	16.73 (3.817)	0.001*

[Table/Fig-7]: Comparison between OHRQoL (Pretreatment) and OHRQoL (Post-treatment) among partially edentulous patients.

*Indicates significant difference at p ≤ 0.05 (Wilcoxon-signed rank test was used)

Questions	Pretreatment Mean (SD)	Post-treatment Mean (SD)	p-value	Percentage decrease (%)
Functional domain	4.31 (1.291)	1.73 (1.106)	0.001*	59.87
Physical pain	5.54 (1.383)	3.00 (1.557)	0.001*	45.85
Psychological discomfort	4.23 (1.547)	2.56 (1.367)	0.001*	39.48
Physical disability	6.15 (1.429)	2.77 (1.403)	0.001*	54.96
Psychological disability	3.65 (1.631)	1.85 (1.414)	0.001*	49.32
Social disability	3.19 (1.497)	2.08 (1.108)	0.001*	34.79
Handicap	4.75 (1.707)	2.48 (1.530)	0.001*	47.79

[Table/Fig-5]: Comparison between pretreatment and post-treatment domain scores of OHIP-14.

*Indicates significant difference at p ≤ 0.05 (Wilcoxon-signed rank test was used)

S. No.	Question	Pretreatment Mean (SD)	Post-treatment Mean (SD)	p-value
1.	Problem in pronouncing words	3.18 (0.982)	0.82 (0.751)	0.003*
2.	Altered sense of taste	1.27 (1.009)	0.73 (0.905)	0.063 (NS)
3.	Difficulty in chewing	3.64 (0.674)	2.09 (1.136)	0.007*
4.	Pain/aching	2.18 (0.603)	0.73 (0.786)	0.004*
5.	Worry about dental problem	3.00 (1.000)	1.45 (0.820)	0.004*
6.	Psychological discomfort	1.36 (1.120)	1.00 (1.000)	0.046*
7.	Problem affecting the diet	2.82 (1.079)	1.27 (0.905)	0.004*
8.	Interruption in meals	3.73 (0.647)	1.36 (1.206)	0.005*
9.	Difficult to relax	0.82 (0.874)	0.45 (0.688)	0.046*
10.	Feeling embarrassed	2.73 (0.905)	1.18 (0.982)	0.007*
11.	Feeling irritable towards others	1.36 (1.027)	0.82 (0.603)	0.034*
12.	Job related difficulties	2.18 (1.079)	1.27 (0.647)	0.008*
13.	Least satisfied in life	2.18 (1.328)	1.36 (1.286)	0.041*
14.	Functional inability	2.36 (1.433)	1.09 (0.831)	0.014*
	Total	32.82 (4.143)	15.64 (3.295)	0.003*

[Table/Fig-6]: Comparison between OHRQoL (Pretreatment) and OHRQoL (Post-treatment) among completely edentulous patients.

*Indicates significant difference at p ≤ 0.05 , NS- no significant decrease (Wilcoxon-signed rank test was used)

DISCUSSION

One of the most commonly occurring variant of mucormycosis is the rhinocerebral type, which affects the nasal and maxillary bone predominantly, causing necrosis of the affected regions. These individuals present with symptoms of facial pain, nasal outflow, and sinusitis with clinical signs of orbital inflammation and necrotic

tissue in the affected region. As the condition progresses, patients suffer from metabolic derangements, uncontrolled diabetes with ketoacidosis, advancing to delirium and progressively leading to death [22]. The radical debridement of the necrosed tissue leads to the formation of maxillofacial defects that adversely affects the psychological, physiological and socio-behavioural state of the individuals. A well fabricated obturator prosthesis is the treatment of choice in such cases, since it seals the defect, facilitating in better mastication, phonetics and aesthetics. Impairment of senses, functional disabilities and compromised aesthetics has a deleterious impact on the Quality of Life (QoL) [23-26]. Nasal leakage of food through the obturator was a common complaint among individuals rehabilitated by an obturator [27]. The size and extent of the defect plays a crucial role in determining the functional efficiency and success of the obturator [28]. In this study, on comparing the pretreatment and post-treatment scores of the subjects, there was a shift of the Likert scale towards the lower scores symbolising the improvement of the general condition of the patient. The results of the study showed a significant percentage decrease in the scores after a prosthetic intervention, in comparison to the scores before any intervention among all the domains of OHIP-14 questionnaire. This reflects on the impact and importance of prosthodontic intervention in ameliorating the OHRQoL of the patients. However, both completely edentulous and partially edentulous patients showed significant decrease in the OHRQoL scores after prosthesis use.

Among 48 subjects, 34 (70.88%) reported a history of diabetes mellitus, which could thus be attributed as a contributing factor in the aetiopathogenesis of post COVID-19 mucormycosis. In a meta-analysis of 851 case reports, it was found that 40% of subjects suffering from mucormycosis also had diabetes mellitus as an ailment [29]. Serum pH is acidic in diabetic ketoacidosis cases leading to iron release from proteins, which harbours the growing fungi [30]. Improvement of the OHRQoL post-treatment could be accredited to good postinsertion counselling, easier mastication without nasal regurgitation, better expression of needs due to enhanced articulation of words or good social acceptance due to improved facial contours [31,32].

The role of a prosthodontist in rehabilitating these patients with maxillo-facial defects, by an obturator is pivotal in creating an anatomical barrier between the oral and nasal cavities to enhance masticatory function, allow proper articulation of speech and render well-monitored healing of the surgically ablated tissues. Comparison between similar studies has been done in [Table/Fig-8] [33-38]. A

Author's name and year of publication of study	Place of study	Number of subjects	Age considered (in years)	Parameters assessed	Conclusion
Depprich R et al., 2011 [33]	Germany	31	Mean age 67.6; range 34-82 years	Quality-of-life following rehabilitation by an obturator	64% positive increment.
Dholam KP et al., 2017 [34]	Mumbai	60	Mean 53; range 14-73	The Liverpool Oral Rehabilitation Questionnaire version 3 (LORQv3) and OHIP 14 questionnaire to assess the Quality of life post rehabilitation	10-27% improvement was found in the domain of oral function, and a 20% improvement in the orofacial appearance for LORQv3 questionnaire, 45-67% improvement in all domains of OHIP-14.
Pisulkar SG et al., 2021 [35]	Wardha, Maharashtra	24	57.6±10.7	Quality of Life among patients treated by maxillectomy and rehabilitated by flap or by an obturator prosthesis	Post prosthodontic rehabilitation showed the quality of life to be 54±22.9%.
Buurman DJ et al., 2020 [36]	Netherlands	19	Mean age 64 years (range 47-78) in Implant supported obturator Group mean age of 71 years (range 59-85) in conventional obturator group	Mixing Ability Test (MAT) and subjectively by three OHRQoL questionnaires: (a) the Oral Health Impact Profile for EDENTulous people (OHIP-EDENT), (b) the Obturator Function Scale (OFS), and (c) the Dutch Liverpool Oral Rehabilitation Questionnaire version 3 (LORQv3-NL).	Supporting prosthetic obturators after maxillectomy with implants improve oral functioning, chewing, and eating comfort.
Kalaignan SP and Ahmed SE, 2021 [37]	Salem, Tamil Nadu	50	Mean age 52	OHIP-Edent-19, Obturator Functioning Scale (OFS-15) and a novel scale—Maxillofacial Prosthesis Performance Scale (MFPPS)	Mean differences of OHIP-Edent (7.260), OFS (6.220) and MFPPS (4.400) were observed after 2 weeks and 3 months of obturator prosthesis function. These findings show significant improvements of prosthesis in terms of functional, physical, psychological and social parameters after long-term follow-up (3 months).
Sullivan M et al., 2002 [38]	Nebraska	32	Mean age 60.9 years (range 23-86 years)	Mean speech intelligibility speaking rate nasality	Betterment from 61-94% Betterment from 138-164 words per minute Decrease from 5.8-1.6 on a scale of 0-7.
Present study, 2022	Nagpur, Maharashtra	48	50.35 years (ranging from 34 to 67 years)	OHRQoL through OHIP 14 questionnaire	Percentage improvement of OHRQoL ranging from 34.79-59.86% post prosthodontic intervention was observed. Thus, the impact of prosthodontic therapy among post COVID-19 mucormycosis affected individuals on the OHRQoL of the patient is positively significant.

[Table/Fig-8]: Studies related to impact of obturator on quality of life [34-39].

proper knowledge of the tissue histology must be applied towards impression-making procedures, to appropriately approximate the prosthetic surface against the tissue surface at various stages of healing. Providing an interim obturator not only rehabilitates the affected individuals on a transient basis but also provides information about the practical challenges of the case and patient-specific prosthetic requirements [39]. This information could be used to assist in the decision-making process for the definitive prosthesis, such as the use of various prosthetic retentive options, customisation of teeth positions based on aesthetic or functional needs.

This study brings to light the role of a prosthodontist in socially, functionally and psychologically rehabilitating individuals with maxillofacial defects and thereby improving the general condition and the QoL of the patient.

Limitation(s)

The sample selected was heterogenous on the grounds of age, gender or span of the defect which can be categorised as limitations of the study. Long-term assessment and follow-up of the same is required to probe any changes due to demographic variability.

CONCLUSION(S)

Post COVID-19 mucormycosis has been a growing public-health concern during the COVID-19 pandemic and has caused significant morbidity, affecting the QoL of patients affected by it. Within the limitations of this study, the percentage improvement of the OHRQoL ranging from 34.79% to 59.86% post prosthodontic intervention was observed. Thus, the impact of prosthodontic therapy among post COVID-19 mucormycosis affected individuals on the OHRQoL of the patient was statistically significant.

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