Prosthetic Status and Needs among Head and Neck Cancer Irradiated Patients Suffering from Xerostomia in Delhi, India

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Abstract

Aim: To assess the prosthetic status and prosthetic needs of Head and Neck Cancer Irradiated Patients suffering from Xerostomia in Delhi India.

Materials and Method: A multi-centric, cross-sectional observational study was conducted among 120 head and neck cancer irradiated patients suffering from xerostomia in Delhi. The information related to socio-demographic data, the prosthetic status, and prosthetic need was obtained using a proforma based on WHO oral health assessment form 1997.

Results: Out of 120 participants, 103 were males and 17 were females. The mean age of the study participants was 47.68 + 10.26 years. Stage 1 carcinoma was diagnosed in 69 (57.5%) of the participants while stage 2 carcinoma was diagnosed in 51 (42.5%) . Out of 120 individuals, 7 (5.8%) needed single unit prosthesis, 33 (27.5%) needed multi-unit prosthesis, 48 (40%) needed a combination of a single and multi-unit prosthesis, and 18 (15%) needed a full prosthesis.

Conclusion: The need for prosthesis was high among Head and Neck Cancer Irradiated Patients. There is a need to emphasize dental service utilization among this group of people.

Keywords*: Head and neck cancer, prosthetic status and needs, radiotherapy, xerostomia*

Introduction

Each year, approximately 500,000 new cases of head and neck cancer (HNC) are diagnosed worldwide. [1] Oral cancers are the most common cancers among head and neck cancers that determine and modify the prosthetic needs of the patient.[2] Head and neck cancers are the eighth most prevalent form of cancer worldwide, usually destructive, and cause extensive tissue damage related to both hard and soft tissues. [2] Treatment modalities include surgery, radiation, and combined surgery and radiation.[3,4]

RT plays a pivotal role in the management of patients with HNC, but it is also associated with several side effects. Commonly, the salivary glands, oral mucosa, and jaws will inevitably be included in the RT field. Changes induced by exposure to radiation occur during and after completion of therapy, which include xerostomia, mucositis, candidiasis, osteoradionecrosis, and radiation caries. [5,6]

Xerostomia or dry mouth is a major side effect of radiotherapy. It is also the most common and permanent

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side effect. Radiation-Induced Xerostomia often occurs as a late effect, however, acute xerostomia after radiotherapy is also known.[7,8] Xerostomia in head and neck cancer patients is associated with a reduced quality of life.[9]This may be due to various complications which include difficulty in swallowing, eating and problems in speaking as well as tooth decay. These patients invariably need dental prosthesis for restoring the lost form and function and thereby enhance their life quality. Further, xerostomia also modifies the ease and compliance for wearing denture prosthesis. However, there is limited data available in the scientific literature on the prosthetic status and needs concerning to cancers of head and neck irradiated patients in India. Hence, this research was done to assess prosthetic status and needs in Head and neck irradiated patients suffering from xerostomia in Delhi.

Materials and Method

This cross-sectional observational study was carried out in the head and neck cancer irradiated patients suffering from xerostomia to understand the prosthetic status and prosthetic needs of such patients. This multi-centric study was conducted among three tertiary care cancer hospitals in Delhi, India. Ethical committee approval and protocol approval was obtained from the Institutional Ethics Committee (IEC) of Manav Rachna Dental College, Faridabad, vide letter number MRDC/ IEC/2018/11.

Patients with the following characteristics were included in the study:

1) Head and neck cancer irradiated patients after 3 months of completion of radiotherapy.

2) Patients who provide informed consent for participation in the study.

3) Patient whose normal whole salivary flow rate < 0.7 ml/min.

Patients who had either learning, audio-visual, psychiatric/ intellectual disability or disorder were excluded from the study. A list of cancer hospitals in Delhi was made to choose the hospitals for study. Out of a total of 10 hospitals, 3 hospitals were chosen using the lottery method. After hospital selection, the permission for conducting the study was taken from these hospital authorities. The research was conducted for 12 months from April 2019 to February 2020 at (Rajiv Gandhi Cancer Hospital), (Balaji Action Cancer Institute) and (Max Hospital, Shalimar Bagh) in Delhi, India.

Sample size:

Sample size calculation was done using a formula for cross-sectional epidemiological studies.

$N = 4 P (1-P)/ d2$

N = Sample size

P = Prevalence of Prosthetic need among the head and neck cancer patients.

d= 10 (Relative Precision of 20%)

Level of Significance- 5%

An earlier study by Jham et al (2008), on the oral health status of 207 head and neck cancer patients before, during, and after radiotherapy found the prevalence of prosthetic needs among these patients as 50.2%.[10]This prevalence rate was used to calculate the sample size for the present study. A non-response rate of 20% was considered and was added to the minimum sample size. A sample size of 120 patients was established for the present study.

Participants who were to be included in the research were briefed about the research by the researcher (SG) and provided with a patient information sheet containing the details of the study, confidentiality, benefits, and risks. The patients were encouraged to clarify any doubts about the research. Those who decided to participate in the study were provided with an informed consent document and asked to sign it in front of an independent witness to ensure that the informed consent process was free and non-coercive. The informed consent document and patient information sheet were made available both in Hindi as well as in English. For the patients who could

not read and write, a person who was independent of the study was made available to read out the patient information sheet and informed consent document. For such patients, a thumbprint was used instead of a signature.

Based on convenience non-probability sampling, all the eligible patients present on the day of the study and gave consent were included. A full medical history of the patient was taken at the outset. The details about the oral cancer staging and grading as well as the diagnosis were obtained from the patient records. The treatment provided including chemotherapy and radiotherapy was noted. The number of cycles of radiotherapy undergone till the date of examination was also noted from the patient records.

For assessment of xerostomia, the patients were instructed to brush their teeth using a soft toothbrush and toothpaste one hour before saliva collection. They were asked to refrain from eating after brushing their teeth. The collection was done in the morning time usually a few hours after breakfast time. Not more than 10-12 patients were examined in a day to avoid examiner fatigue.

The Swab method was used to measure xerostomia. Three pre-weighed cotton swabs were placed into the mouth of the patient. The swabs were placed at three locations on the floor of the mouth to facilitate maximum possible saliva absorption. The patient was asked not to swallow saliva for 5 minutes. The cotton swab was then retrieved and collected in a corked test tube and weighed. A digital scale (Kerro P5B,BL 3000) was used to weigh the cotton swab before and after the procedure. The difference of weight between dry and saliva-soaked pellet was recorded. The rate of salivary flow was expressed in the units of ml per minute. A weight of one gram was considered to be equal to one ml.

The enrolled patients were then interviewed to obtain data on socio-demographic variables ie education, occupation, annual income. Socio-economic status was calculated using the Kuppuswamy scale updated for 2019. This was followed by oral examination, which was performed by a single calibrated examiner who assessed the dental prosthetic status and treatment needs according to the criteria described in the WHO Oral health assessment form 1997.[11]

Intraoral examination of the patient was done in the type II setting. All the data were tabulated in Microsoft Excel. Data were analyzed through IBM SPSS™ Statistics for Windows, version 20.0 (IBM Inc., Armonk, NY, USA). Descriptive statistics and differences among prosthetic status and prosthetic needs, according to gender, age, grade, stage of cancer, and socio-economic status were calculated using Chi-square test. All the statistics were considered significant at a P-value of equal to or less than 0.05.

Results

The total number of participants included in this study was 120. The mean age of the study sample was 47.68 + 10.26 years. The largest number of individuals belonged to the age group of 51 to 60 years (n=43, 35.8%). The number of participants in the 18-30 years age group was 7 (5.8%), 31 to 40 years age group was 25 (20.8%), 41 to 50 year age group was 37 (30.8%) and 61 to 70 years was 8 (6.7%). The sample was predominantly men as 103 (85.8%) of the study participants were men. On the other hand, 17 participants (13.3%) were women. Most of the participants belonged to upper-middle and upper-lower socio-economic strata. The study sample comprised of 8 (6.7%) participants from lower SES, 23 (19.2%) from lower-middle SES, 42 (35.0%) from upper-lower, 45 (37.5%) from upper-middle, and 2 (1.7%) from upper SES.

Stage 1 carcinoma was diagnosed in 70 (57.5%) of the participants while stage 2 carcinoma was diagnosed in 50 (42.5%) population. While 44 (36.7%) participants received concomitant chemotherapy, 76 (63.3%) participants did not receive chemotherapy. The mean number of radiotherapy cycles obtained by the respondents was 18.4 (SD = 8.881) with a range from minimum of 2 cycles to a maximum of 35 cycles.

The majority of the people in the study sample brush once a day (n = 116, 96.7%) while 2 people each do not brush their teeth or brush twice a day. About 81% (n=126) patients had not visited the dentist in past 12 months while 18.2% (n = 28) participants had visited dentist in past 12 months.

According to table 1, the proportional difference in prosthetic status among genders was not found to be significant in the present study sample (χ^2 = 3.440, p=0.969). The proportional difference in prosthetic status among different socioeconomic strata was not found to be significant in the present study sample (χ^2 = 21.768, p=0.353). The proportional difference in prosthetic status among patients with stage 1 and stage 2 cancer was not found to be significant in the present study sample (χ^2 = 1.228, p=0.746). The proportional difference in prosthetic status among patients who received and did not receive chemotherapy was found to be statistically significant in the present study sample (χ2 = 13.568, p=0.019). (Table 1)

According to table 2, the proportional difference in prosthetic needs among genders was not found to be significant in the present study sample (χ^2 = 7.115, p=0.524). The proportional difference in prosthetic needs among different socioeconomic strata was not found to be significant in the present study sample (χ^2 = 21.096, p=0.175). The proportional difference in prosthetic needs among patients with stage 1 and stage 2 cancer was not found to be significant in the present study sample (χ^2 = 1.228, p=0.746). The proportional difference in prosthetic needs among patients who received and did not receive chemotherapy was found to be statistically significant in the present study sample (χ^2 = 11.446, p=0.022). (Table 2)

The highest percentage of individuals (n=38, 31.7%) had 14 teeth in their upper dentition, while only 1 person (0.8%) had 4 teeth. Fourteen teeth were present in 36.7% of the population (n=44) which was the highest number, while 8 teeth were present only in 1 person (0.8%). The minimum number of teeth present was 5.

Table 3 shows the distribution of population according to the number of teeth requiring replacement A total of 46 participants did not need any replacement of teeth. Of the other participants who needed replacement, the highest number (n=16),13.3% needed replacement of 4 teeth, followed by 14 participants needing replacement of 7 teeth and 12(10%) each needing replacement of 6 and 8 teeth. (Table 3)

Of a total of 120, 75% (n=90) did not have any prosthesis, 10.8% (n=13) had one bridge while 3.3% (n==4) had more than one crown and bridge prosthesis in their mouth. Partial dentures were seen in n=10 (8.3%) participants, (n=2) (1.7%) had bridge and partial denture both while (0.8%) n=1, person had a complete denture prosthesis.(Table 4)

Only (11.7%) n=14of the total study sample had no prosthetic needs. Of the total of 120 individuals, n=7 (5.8%) needed a single unit prosthesis, n=33 (27.5%) needed multi-unit prosthesis, n=48 (40%) needed a combination of a single and multi-unit prosthesis, and n=18 (15%) needed a full prosthesis. (Table 5)

Table 1. Prosthetic status according to gender

Gender	Prosthetic Status						
	No Prosthesis	Bridge	>1 bridge	Partial Denture	Both Bridge and Partial Denture	Complete Denture	Tests & P value
Male	75	11	4	10	2	1	$\chi2 = 3.440$, $p = 0.969$
Female	15	2	0	0	0	0	
Total	90	13	4	10	2	1	
Socioeconomic Status							
Lower	7	1	0	0	0	0	$\chi2 = 21.768$, $p = 0.353$
Lower Middle	17	5	0	1	0	0	
Upper	2	0	0	0	0	0	
Upper Lower	29	4	0	7	2	0	
Upper Middle	35	3	4	2	0	1	
Total	90	13	4	10	2	1	
Stage of cancer							
Stage I	61	4	0	4	1	0	$\chi2 = 1.228$, $p = 0.746$
Stage II	29	9	4	6	1	1	
Total	90	13	4	10	2	1	
Chemotherapy							$\chi2 = 13.568$, $p = 0.019$
No	62	8	1	2	2	1	
Yes	28	5	3	8	0	0	
Total	90	13	4	10	2	1	

Table 2. Prosthetic needs according to gender

Gender	Prosthetic Needs					
	No Prosthesis Needed	Need For One Unit Prosthesis	Need For Multi Unit Prosthesis	Need For Combination Prosthesis	Need For Full Prosthesis	Tests & P value
Male	10	7	29	41	16	$\chi2 = 7.115$, p=0.524
Female	4	0	4	7	2	
Total	14	7	33	48	18	
Socioeconomic status						
Lower	2	0	2	4	0	$\chi2 = 21.096$, p=0.175
Lower Middle	2	2	7	4	8	
Upper	0	0	0	2	0	
Upper Lower	5	1	9	20	7	
Upper Middle	5	4	15	18	3	
Total	14	7	33	48	18	
Stage of Cancer						
Stage 1	13	2	15	32	8	$\chi2 = 1.228$, p=0.746
Stage 2	1	5	18	16	10	
Total	14	7	33	48	18	
Chemotherapy						
No	9	7	26	25	9	$\chi2 = 11.446$, p=0.022
Yes	5	0	7	23	9	
Total	14	7	33	48	18	

Table 3 Number of teeth needing replacement

Number of teeth to be replaced	Frequency	Percent
0	46	38.4%
1.0	1	0.8%
2.0	2	1.7%
4.0	16	13.3%
5.0	2	1.7%
6.0	12	10%
7.0	14	11.7%
8.0	12	10%
9.0	1	0.8%
12.0	5	4.2%
14.0	1	0.8%
15.0	2	1.7%

Table 4 Prosthetic Status of the Population

Prosthetic Status	Frequency	Percent
No Prosthesis	90	75.0
Bridge	13	10.8
More than one bridge	4	3.3
Partial Denture	10	8.3
Bridge and Partial Denture	2	1.7
Full Removable Denture	1	.8
Total	120	100.0

Table 5. Prosthetic needs of study sample

Prosthetic Needs	Frequency	Percent
No Prosthesis Needed	14	11.7
Single Unit Prosthesis	7	5.8
Multi Unit Prosthesis	33	27.5
Combination of One And / Or Multi Unit Prosthesis	48	40.0
Full Prosthesis	18	15.0
Total	120	100.0

Discussion

Prosthetic needs increase with age and the presence of health-related conditions. Head and neck cancers may be directly responsible for tooth loss due to the infiltration of cancer cells into the surrounding dental tissues including the support structures of teeth. Additionally, radiotherapy in head and neck cancers may be one of the major reasons for xerostomia or dry mouth and subsequently for dental caries leading to loss of a tooth. Thus, it is premised that prosthetic status and needs of head and neck cancer irradiated subjects may differ from those of individuals not under radiotherapy as well as healthy individuals.[12–14]

The present study showed that there was a statistically significant difference in the proportion of patients using prosthesis among those who had undergone radiotherapy and those who were not given radiotherapy. The proportion of people using prosthesis was lower in the irradiated patients as compared to radiated ones. On the other hand, the prosthetic needs of irradiated patients were higher than of the non-irradiated patients. Many of these patients needed multi-unit or a combination of a single and multi-unit prosthesis. It may be explained that since there are higher needs and lower use of prosthesis in irradiated patients, much of the need that has arisen might be a recent one. This may be due to the impact of radiotherapy on the health of oral tissues. The causes of this difference among irradiated and non-irradiated patients need to be affirmed through the establishment of sound evidence indicating the cause.

A significantly higher percentage of subjects in the upper SES categories had some kind of prosthesis as compared to subjects in the lower SES category. The social pressure of maintaining the esthetics and function could be the driving force that influences the subjects in the upper class to get their missing teeth replaced.[15] In addition to this, the attitude and awareness toward dental care, and the cost of dental treatment might also be the significant factor that determines the prosthetic status of a person.

According to database data available online, the present study is the first one to assess the prosthetic status among head and neck cancer patients who underwent treatment during the time of the study. The study showed that about 25% of the sample used one or the other kind of prosthesis. Of those who needed prosthesis, about 67% of the individuals required a multi-unit or a combination prosthesis. Hence there was an extensive tooth loss in the population with a large number of those who needed prosthesis requiring

long span and complex prosthesis. This indicates the complex process of tooth loss among head and neck cancer patients. Many causative elements may work in tooth loss including the effect of pathology as well as the treatment including radiotherapy and chemotherapy on the teeth and their supporting structures. All these factors should be considered as a part of the multifaceted etiology leading to tooth loss in such patients.

Geographical as well as demographic features of the population under study have an important influence on the results.[16]The present study was conducted in the capital of India. It is predominantly urban area with high availability of healthcare facilities and higher health literacy among the residents. However large variations are seen among the health parameters within this geographical region. These are mainly related to socio-economic status. These factors may result in different health-related status among different population groups.[17 -20] For a health-related condition such as head and neck cancer, these variations may be the primary reasons for the difference in dentition status among various groups. Since, upper-middle and upper-lower socio-economic strata formed the majority of the study sample, this may affect the overall prosthetic status of patients in the present study.

The results of this study show that almost 64% of individuals had at least one missing tooth except for third molars in the lower arch, while this percentage was close to 70% of individuals having at least one missing tooth in the upper arch. The percentage of patients with some kind of prosthesis was 25%. Prosthetic status was better than those of healthy elderly in Kerala as seen in a study conducted by Joseph et al (2016) where 18.2% had dentures. [21] However, the prosthetic need in the present study was also higher at almost 88% of patients requiring prosthesis as compared to about 63% in Joseph et al study. According to the another study conducted by Yadav et al (2016) among institutionalized elderly in Delhi in which the prosthetic status and needs were determined, about 25% of participants required prosthesis as compared to 88% in the present study. [22]This reflects the difference between prosthetic needs of healthy and head and neck cancer irradiated individuals. The higher prosthetic needs in cancer irradiated patients may be attributed to the pathologic process of cancer as well as conditions such as xerostomia that lead to enhanced tooth loss after cancer radiotherapy. [23]

The present study could not compare the differences among males and females because only 17 (15%) of the study sample were females. However, various studies assessing prosthetic needs in India showed that females have higher prosthetic needs when compared to their male counterparts.[24,25] There were also studies showing results in contrast. [26,27]

A weakness of the study was that patients at various doses of radiation therapy were included in the study. There may be differences in the dentition status between various doses of radiotherapy concerning their oral health and oral healthcare needs.

Conclusion

The present study established a high oral health risk as well as a high oral disease burden in the head and neck irradiated population of Delhi. It also indicates towards the adoption of a robust framework integrated with a treatment plan for this population. A collaborative teamwork of oncologist and prosthodontist on a cohesive treatment plan for head and neck cancer will not only help in reducing the oral disease burden in this population but also help in improving oral health-related as well as general health-related quality of life among these patients.

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Conflict of Interest – Nil

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