

## Oral Health Status and Quality of Life Among Head and Neck Cancer Subjects Receiving Radiotherapy

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### Abstract

Head and neck cancer subjects undergoing radiation therapy encounter multiple side effects that greatly affect health related quality of life (HRQoL) and oral health related quality of life (OHRQoL). The literature pertaining to impact of head and neck cancer, radiotherapy including its complications on HRQoL and OHRQoL are scarce.

To assess the oral health status and quality of life among head and neck cancer subjects receiving radiotherapy and to compare with age and gender matched controls.

A cross-sectional study was conducted among 150 Head and neck cancer subjects receiving radiotherapy and 150 healthy subjects in Bangalore city. Short Form Health Survey (SF-12), Oral Health Impact Profile-14 (OHIP-14) and World Health Organization (WHO) 2013 oral health proforma were used. Statistical tests were applied. A p value of <0.05 was considered as significant.

Head and neck cancer group had significantly lower SF-12 scores and higher OHIP-14 scores than Control group. Caries experience, gingival bleeding, pocket and loss of attachment were significantly higher among Head and neck cancer group than Control group. Radiation dosage had a weak significant negative correlation with SF-12 and weak significant positive correlation with OHIP-14. Radiation dosage and OHIP-14 had a weak significant positive correlation with dental caries and periodontal conditions. SF-12 had a weak significant negative correlation with dental caries and periodontal conditions.

Head and neck cancer subjects had poor oral health status and quality of life which might be due to radiotherapy.

**Clinical article (J Int Dent Med Res 2022; 15(1): 263-267)**

**Keywords:** Dental caries; head and neck cancer; oral health status; Quality of Life; radiotherapy.

**Received date:** 17 November 2021

**Accept date:** 21 December 2021

### Introduction

Cancer is one of the deadliest diseases.<sup>1</sup> It has afflicted mankind since time immemorial although it was rare in ancient people. Worldwide, Head and neck cancer (HNC) represents the sixth most common neoplasia. Cancer is a major cause of morbidity and mortality in India. Oral cancer has a high incidence in specific geographic regions worldwide. High incidence of

oral cancer in India is attributed to a number of etiological factors which include use of tobacco and alcoholism.<sup>2,3</sup> Surgery, chemotherapy and radiotherapy are the options for treatment of head and neck cancers.<sup>4,5</sup>

Head and neck cancers (HNC) are often treated with radiation therapy (RT).<sup>3,4</sup> Cancer patients undergoing radiation therapy (RT) of the head and neck encounter many adverse effects.<sup>5,6</sup> Head and neck cancer and the side-effects of the treatment have a negative impact on many different aspects of quality of life (QoL) over time.<sup>6,7</sup>

Health-related quality of life (HRQoL) is a multidimensional concept which looks at the way which patients feel about themselves in the context of a medical condition.<sup>8,9</sup> Oral health related quality of life (OHRQoL) is the self-evaluation of functional, psychological,

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sociological conditions that are affected by oral health condition.<sup>7</sup> Treating head and neck cancer produces important changes in the oral cavity which impairs normal functions such as speech, swallowing, chewing and salivation.<sup>8,9</sup> The oral complications of therapy for head and neck cancer can significantly impair quality of life.<sup>10,11</sup>

Earlier studies have assessed oral health status<sup>12-18</sup>, HRQoL<sup>8,9,13</sup> and OHRQoL<sup>10,13,19-21</sup> in this population. The studies have revealed that oral health status and OHRQoL are adversely affected in head and neck cancer subjects receiving radiotherapy. However the relationship between oral health status and HRQoL during radiotherapy remains unexplored. The literature on impact of head and neck cancer, radiotherapy and its complications on HRQoL and OHRQoL are scarce.

This study was conducted with the objective to assess and compare the oral health status, health related quality of life and oral health related quality of life in head and neck cancer subjects receiving radiotherapy and healthy subjects.

### Materials and methods

A cross-sectional study was conducted among head and neck cancer subjects receiving radiotherapy and age and gender matched healthy subjects from November 2016-May 2018 in Bangalore city. Ethical clearance was obtained from Institutional Ethical Committee (No.GDCRI/ACM/PG/PHD/5/2016-17).

Necessary permission was obtained from hospital authorities. Informed consent was obtained from the study participants after explaining the purpose and procedure clearly. The study was carried out in accordance with the World Medical Association Declaration of Helsinki. The investigator was trained and calibrated prior to start of the study to ensure reliability ( $k=0.80$ ). Short Form Health Survey (SF-12)<sup>22</sup>, Oral Health Impact Profile-14 (OHIP-14)<sup>23</sup> and World Health Organization (WHO) 2013 oral health proforma<sup>24</sup> were used to assess HRQoL, OHRQoL and oral health status respectively. Cross cultural validation of SF-12 and OHIP-14 questionnaires was performed by means of back-translation (English to Kannada) method with help of linguistic experts. It was assessed for readability and comprehension during pilot study on a group of 20 study

subjects. Necessary corrections and modifications were made. Internal consistency ( $\alpha$ ) was found to be good for SF-12(0.80) and OHIP-14(0.88). A pilot study was conducted among 20 head and neck cancer subjects receiving radiotherapy to check the feasibility of the study and to calculate the sample size. Based on the prevalence of dental caries, the sample size of 144.06 was obtained which was rounded off to 150 (Prevalence of dental caries=80%, statistical power =80%,  $Z_{\alpha}=1.96$  at 95% confidence interval, E= margin of error-10%, Design effect, D=1.5). Hence 150 head and neck cancer subjects receiving radiotherapy and 150 age and gender matched healthy subjects (subjects' attendants) were recruited based on the eligibility criteria.

Head and neck cancer subjects aged 18 years and above diagnosed with head and neck cancer, undergoing radiotherapy for a minimum period of 1 month; radiation dosage  $\geq 30$  Gray units with a minimum of 20 sittings, with minimum twenty functional teeth and who can read and understand Kannada/English were included in the study. Subjects having head and neck cancer and cancers in other parts of the body, having conditions that make assessment of oral health status difficult such as partial maxilla, partial mandible and restricted mouth opening and those with chronic systemic diseases that may have influence on oral health were excluded. Age and gender matched subjects free of head and neck cancer and other cancers with minimum twenty functional teeth and who can read and understand Kannada/English were included in the study as controls. Subjects having conditions that make assessment of oral health status difficult such as partial maxilla, partial mandible and restricted mouth opening and those with chronic systemic diseases that may have influence on oral health were excluded.

The study subjects were recruited based on inclusion and exclusion criteria from two hospitals that were randomly selected from the list of hospitals in Bangalore.<sup>25</sup> Data were collected using a structured questionnaire followed by clinical examination by a single calibrated investigator and recorded by a trained assistant. Demographic profile and oral hygiene habits were assessed through interview. Socioeconomic status (SES) was assessed using modified Kuppaswamy classification.<sup>26</sup> Details regarding head and neck cancer and

radiotherapy were obtained from the hospital records. Subjects were examined by a single calibrated investigator. Dental caries and periodontal status were recorded using WHO 2013 oral health proforma for adults.<sup>24</sup> Infection control procedures were observed throughout the study. Data was analyzed using the Statistical Package for Social Sciences (IBM SPSS Statistics V22.0). Descriptive and inferential statistical analyses were done. Chi square test/ Fisher exact test, Unpaired t-test, Mann-Whitney U test, Pearson's correlation and Spearman's correlation were applied. A *p* value of <0.05 was considered as significant.

### Results

In this study, 150 head and neck cancer subjects and 150 healthy subjects (Controls) were present. There was no statistically significant difference with regard to age (*p*=0.21), gender (*p*=0.45) and socioeconomic status (*p*=0.44) among the study groups. (Table 1)

Demographic data		Head and neck cancer group N=150	Control group N=150
Age (years) *	Mean ± S.D	49.75± 13.44	46.57± 14.16
Gender †	Males	99 (66.0)	105 (70.0)
	Females	51 (34.0)	45 (30.0)
Socioeconomic status ††	Upper (I)	0 (0)	0 (0)
	Upper middle (II)	06 (4.0)	11 (7.3)
	Lower middle (III)	124 (82.7)	121 (80.7)
	Upper lower (IV)	20 (13.3)	18 (12.0)
	Lower (V)	0 (0)	0 (0)

**Table 1.** Demographic characteristics of the study participants.

\**p*=0.21; †*p*=0.45; ††*p*=0.44

Mean SF-12 was significantly lower among Head and neck cancer group (30.89±4.66) as compared to Control group (36.14±3.75). (Table 2) Mean OHIP-14 was significantly higher among Head and neck cancer group (18.35±7.48) as compared to Control group (11.14± 8.18) (Table 3) Mean DMFT scores were significantly higher in Head and neck cancer group (4.34 ± 4.87) than Control group (2.60 ± 3.60) (*p*<0.001). (Table 4). Head and neck cancer subjects had significantly higher mean number of teeth with loss of attachment (2.48±3.71) than Control group (0.88±0.97)

(*p*<0.001).(Table 5)

Domains	Head and neck cancer group (Mean ± S.D)	Control group (Mean ± S.D)	<i>p</i> value
General health	3.04±0.92	3.22±0.81	0.001
Physical functioning	5.68±0.64	5.94±0.38	<0.001
Role functioning-Physical	3.34±0.80	3.69±0.49	<0.001
Role functioning - Emotional	3.43±0.86	3.68±0.68	0.005
Bodily pain	3.44±1.14	4.65±0.70	<0.001
Mental health	5.62±1.66	7.36±1.42	<0.001
Vitality	2.72±0.99	3.67±0.72	<0.001
Social functioning	3.63±0.80	3.91±0.73	0.01
Mean of SF-12 ± S.D	30.89±4.66	36.14±3.75	<0.001

**Table 2.** Domain-Wise Mean SF-12 scores of study groups.

Domains	Head and neck cancer group (Mean ± S.D)	Control group (Mean ± S.D)	<i>p</i> value
Functional limitation	4.45±1.54	3.08±1.98	<0.001
Physical pain	4.28±1.96	2.22±1.72	<0.001
Psychological discomfort	2.10±1.82	1.51±1.49	0.002
Physical disability	2.45±1.85	1.52±1.45	<0.001
Psychological disability	1.44±1.42	0.71±0.35	<0.001
Social disability	1.88±1.68	1.10±0.41	<0.001
Handicap	1.73±1.52	0.97±0.78	<0.001
Mean of OHIP-14 ± S.D	18.35±7.48	11.14± 8.18	<0.001

**Table 3.** Domain-Wise Mean OHIP-14 scores of study groups.

Caries experience	Head and neck cancer group (Mean ± S.D)	Control group (Mean ± S.D)	<i>p</i> value
DT	3.52±4.25	2.11±3.25	<0.001
MT	0.43±0.83	0.14±0.49	<0.001
FT	0.38±0.98	0.34±0.72	0.15
DMFT	4.34 ± 4.87	2.60 ± 3.60	<0.001

**Table 4.** Mean caries experience (DMFT) among study groups.

Periodontal conditions	Head and neck cancer group (Mean ± S.D)	Control group (Mean ± S.D)	<i>p</i> value
Healthy	7.92±5.31	20.50±8.05	<0.001
Gingival bleeding	18.34±10.68	7.27±7.77	<0.001
Pocket	2.29±2.82	1.28±1.95	<0.001
Loss of attachment	2.48±3.71	0.88±0.97	<0.001

**Table 5.** Mean CPI score with loss of attachment per teeth among study groups.

Correlations	r value	p value
Radiation dosage versus SF-12	-0.238	<b>0.003</b>
Radiation dosage versus OHIP-14	0.228	<b>0.005</b>
SF-12 versus OHIP-14	-0.367	<b>&lt;0.001</b>

**Table 6.** Correlation between radiation dosage, SF-12 and OHIP-14.

	DMFT	Gingival bleeding	Pocket	Loss of attachment
<b>Radiation dosage</b>	0.275*	0.318*	0.306*	0.319*
<b>SF-12</b>	-0.342*	-0.176*	-0.162*	-0.186*
<b>OHIP-14</b>	0.160*	0.206*	0.224*	0.129*

**Table 7.** Correlation between radiation dosage, SF-12, OHIP-14, DMFT and CPI scores.

\*rho value; p<0.001

A weak significant negative correlation was found between 'radiation dosage' and 'Health related quality of life' ( $r = -0.238$ ,  $p=0.003$ ). A weak significant positive correlation was found between 'radiation dosage' and 'Oral health related quality of life' ( $r = 0.228$ ,  $p=0.005$ ). A weak significant negative correlation was observed between 'Health related quality of life' and 'Oral health related quality of life' ( $r = -0.367$ ,  $p<0.001$ ). (Table 6) 'Radiation dosage' had a weak significant positive correlation with 'dental caries' ( $\rho = 0.275$ ,  $p=0.001$ ); 'gingival bleeding' ( $\rho = 0.318$ ,  $p<0.001$ ); 'pocket' ( $\rho = 0.306$ ,  $p<0.001$ ) and 'loss of attachment' ( $\rho = 0.319$ ,  $p<0.001$ ) (Table 7) 'Health related quality of life' had a weak significant negative correlation with 'dental caries' ( $\rho = -0.342$ ,  $p<0.001$ ); 'gingival bleeding' ( $\rho = -0.176$ ,  $p=0.002$ ); 'pocket' ( $\rho = -0.162$ ,  $p=0.005$ ) and 'loss of attachment' ( $\rho = -0.186$ ,  $p=0.001$ ). (Table 7)

## Discussion

Cancer is a main public health burden in both developed and developing countries.<sup>27</sup> Radiotherapy is the treatment of cancer with external beam of radiation.<sup>2</sup> The common oral complications of head and neck radiation therapy are xerostomia, oral mucositis, taste loss, dental caries and accelerated periodontal disease.<sup>7</sup> Radiotherapy can lead to significant post-operative morbidity and has detrimental impacts on health related quality of life.<sup>10</sup> Mean SF-12 was significantly lower among Head and neck

cancer group as compared to Control group suggesting poor health related quality of life among head and neck cancer subjects. A study reported similar mean score in Head and neck cancer subjects.<sup>13</sup>

Poor oral health and untreated oral diseases can have deep effect on oral health related quality of life.<sup>21</sup> Mean OHIP-14 was significantly higher among Head and neck cancer group as compared to Control group which shows that oral health related quality of life was poor among head and neck cancer subjects. A study reported similar mean score in Head and neck cancer subjects.<sup>10</sup> The adverse effects of RT on dentition are mainly due to a reduction in salivary flow rate increases the risk of dental caries.<sup>11</sup> Mean DMFT scores were significantly higher in Head and neck cancer group than Control group which was in line with a study.<sup>17</sup> RT effects on periodontal health include increased risk of periodontal disease and altered healing with impaired capacity for bone remodelling and repair. Mean number of teeth with gingival bleeding, pocket and loss of attachment were significantly higher among Head and neck cancer group as compared to Control group which was in line with a study.<sup>12</sup> Radiation dosage had a weak significant negative correlation with HRQoL and weak significant positive correlation with OHRQoL suggesting a relationship between radiation dosage, general and oral health and well-being and health related quality of life. This finding was in accordance with one study.<sup>19</sup> Radiation dosage and OHRQoL had a weak significant positive correlation with dental caries and periodontal conditions. HRQoL had a weak significant negative correlation with dental caries and periodontal conditions. These findings were in accordance with one study.<sup>13</sup>

The present study has certain strengths and limitations. To the best of our knowledge, the current study is the first of its kind to explore association between oral health status, HRQoL and OHRQoL among Head and neck cancer subjects receiving radiotherapy. The study also focused on the impact of radiation dosage on oral health status and quality of life.

Cross sectional study design does not allow assessment of causality between study variables. Bias inherent in questionnaire studies such as response bias, social desirability bias might be found in this study. Further, the generalizability of this study results may be

affected according to the standard of care rendered by the specialists and based on the infrastructure facilities at the oncology hospitals. Prospective and longitudinal designs with repeated measurements of oral health status, HRQoL and OHRQoL are needed to understand the changes in the study variables before, during and following treatment are recommended while undertaking further studies.

## Conclusions

Oral health status, health related quality of life and oral health related quality of life of Head and neck cancer group was poor compared to control group. Radiotherapy had a significant negative impact on health related quality of life, oral health related quality of life and oral health status of head and neck cancer subjects.

## Acknowledgements

All authors have made substantial contribution to this study. This study is not funded.

## Declaration of Interest

The authors report no conflict of interest.

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