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Original Article

A Prospective Study of the Incidence of Chronic Xerostomia and the Quality of Life in Patients Undergoing Radiotherapy for Head and Neck Malignancies with IMRT or VMAT Techniques

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Abstract

Background: Radiation therapy in Head and neck cancers often leads to xerostomia which often leads to a decline in quality of life. The aim of the study was to compare xerostomia among cancer patients undergoing IMRT and VMAT techniques for head and neck malignancies and follow them up via quality of life assessment.

Methodology: It was a hospital based prospective study with follow up at 0, 3 and 6 months among total 80 patients divided in 2 groups of VMAT and IMRT respectively. Patients were assessed using a quality of life questionnaire. Data analysis was done using SPSS 25.0

Results: It was observed that there was no significant difference between the two groups for xerostomia and quality of life over the follow up period. However, there was improvement of symptoms over time in both groups.

Discussion: Similar results were observed in other international studies as well with respect to the quality of life.

Conclusion: It was found that both technologies were similar when it came to treatment related xerostomia in patients undergoing radiotherapy for head and neck malignancies with either technique.

Keywords: Quality of Life, Intensity–Modulated Radiotherapy, Xerostomia, Head and Neck Neoplasms

Introduction

Concurrent chemo– radiation forms an important modality of treatment for locally advanced squamous cell carcinoma of the head and neck[(1)]. Surgery was once the mainstay of treatment for all resectable cases of head and neck cancer but it led to significant morbidity. Radiotherapy was reserved for unresectable or palliative cases, but now concurrent chemo– radiation is the primary local treatment option for most head and neck cancers, largely in the setting of organ–conservation approaches to treatment. In addition, for those patients who are managed with primary surgical resection, patients at high risk of loco–regional recurrence are often treated with either adjuvant radiotherapy alone or adjuvant concurrent chemo– radiotherapy.

Treatment with radiotherapy can cause severe acute and late toxicity, in particular xerostomia and dysphagia, influencing the quality of life (QoL) of patients with head and neck cancers[(2)]. Xerostomia is the most common long term toxicity seen in patients receiving radiotherapy for oral cavity tumors[(3)].

The term "Xerostomia" is derived from the Greek words *xeros* that means "dry" and *stoma* means "mouth"[(4)]. It leads to disruption of normal swallowing function, inadequate oral alimentation, thus leading to nutritional deficiency and weight loss– contributing to poor disease related outcome[(5)]. Radiation–induced damage to the salivary glands alters the volume, consistency, and pH of secreted saliva. Saliva changes from thin secretions with a neutral pH to a thick, tenacious secretions with an acidic

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pH[6]. Patients suffer from oral pain, difficulty in vocalising, chewing and swallowing and have a higher incidence of dental caries as well as oral infections.

Saliva is an important host defence mechanism of the oral cavity[7]. The saliva is contributed by major and the minor salivary glands. Major salivary glands contribute to most of the secretion volume and electrolyte content of saliva (the parotid, submandibular, and sublingual glands, which account for 90% of saliva production), whereas minor salivary glands contribute little to the secretion volume[8].

Parotid injury during the radiation process happens because radiation leads to selective membrane damage of acini causing deficient water secretion leading to thick viscous saliva initially; and as there is radiation induced cellular apoptosis, the newly formed cells are ill–equipped to secrete saliva due to poor micro vasculature and thus suffer from a compromised blood supply[9].

Studies revealed that severe xerostomia (Grade III) ensues if the contralateral Parotid gland receives doses in excess of 35 Gy. If the dose to the Submandibular salivary gland may be kept below 26 Gy, the incidence of severe Dry Mouth may be kept low[10]. Other factors, specific to the patient or the treatment, may contribute to the development of severe xerostomia, like site of the tumour, clinical stage of tumour, chemotherapy and technique used for radiotherapy[5].

The Parotid–sparing intensity modulated versus conventional radiotherapy in head and neck cancer (PARSPORT) trial compared the incidence of xerostomia in pharyngeal cancers and successfully concluded the benefits of parotid sparing Intensity Modulated Radio Therapy (IMRT) over conventional 3 Dimensional–Conformal Radiotherapy (3D–CRT) with respect to acute and chronic xerostomia and mucositis. Significant benefits were seen in recovery of salivary secretion with IMRT compared with conventional radiotherapy with clinically significant improvements in dry–mouth–specific and global quality of life scores[11].

Ever–since, IMRT has been used as the standard of care for head and neck malignancies with significant benefits over 3D–CRT in terms of acute mucositis and chronic xerostomia. Volumetric Modulated Arc Radiotherapy (VMAT) is a new type of IMRT technique in which the Radiotherapy machine rotates around the patient during treatment, continuously reshaping and changing the intensity of the radiation beam as it moves around the body[12].

Thariat et al (2010) studied the conservation of salivary function by newer techniques in a review article. They observed that IMRT requires treatment beams to be sequenced one after another. For continuous sequencing, radiation with continuous accelerator–arm rotation was developed. This facilitated multiplication of the beam entry points, optimizing ballistics. The concept of "cyclotherapy" is not new, but its implementation was outdated; therefore, the Varian corporation developed a solution called RapidArc, performing IMRT in rotation and modulating the dose rate by modulating the speed of rotation of the arm around the patient, with continuous leaf movement. The Elekta corporation developed a similar solution, with some technical variants, known as VMAT. These modulated arc therapy devices reduce the number of monitor units and the processing time compared to IMRT. Arc therapy can be used for conservation of salivary function, with the possibility of a more homogeneous dose distribution, fewer high–dose areas, and better conformation to the salivary glands[13].

The aim of this study was to compare the severity of Chronic Xerostomia (Dry Mouth) associated with IMRT and VMAT by CTCAE version 4.0. at the time of worst symptoms of Xerostomia during treatment (t= 0 months) and at 3 months and 6 months of finishing treatment.

Patients and Methods

- Study site: Department of Radiation Oncology, Apollo Specialty Hospitals, Chennai, India
- Study population: HNC patients (age>18 years) receiving radiation by IMRT(parotid sparing) or VMAT in which bilateral salivary glands are in the field of Radiation
- Study design: Prospective observational study
- Sample size: 80

Sample size calculation:

Using the formula:

$$n = (Z\alpha/2+Z\beta)^2 (p1(1-p1)+p2(1-p2)) / (p1-p2)^2,$$

where $Z\alpha/2$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), $Z\beta$ is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84) and p1 and p2 are the expected sample proportions of the two groups.

where,

p1= 73% (from the PARSPORT TRIAL)[11]

p2= 38% (from the PARSPORT TRIAL)[11]

By applying the above formula, the required sample size is 40 cases in each arm = **Total =80**

Duration of study

January 2019 to January 2020

Selection of Patients: Ethical Clearance was obtained from the Institutional Ethics Committee.

- **Inclusion criteria**: HNC patients (age>18 years) receiving concurrent chemo– radiation by IMRT (parotid sparing) or VMAT in which bilateral salivary glands are in the field of Radiation.
- **Exclusion criteria:**

1. Parotid surgeries
2. Previous head and neck Radiation
3. Previous malignancy
4. Parotid tumour
5. Patients on prophylactic Amifostine or Pilocarpine

Planning objectives:

Volume of PTV(%)	% Prescribed Dose
99	>90
95	>95
50	100
5	<105
2	<107

Method of Analysis

Pre–treatment evaluation was done by a Radiation Oncologist, a Medical Oncologist and a Radiologist. It comprised of clinical examination, complete blood investigations, liver function tests, renal function tests, imaging including chest X– ray, Computed Tomography (CT) scan of the head and neck.

After staging work up, patients were counselled about the radiation therapy, techniques and side effects. After explaining to the patients and getting an informed consent, they were taken up for radiotherapy preparation. Relevant clinical data for the study, as described below were collected and noted down in the study proforma.

Radiotherapy preparation consisted of immobilization using a neck rest and thermoplastic mask. A CT scan (CT_{plan}) of the head and neck region from the base of the skull to superior mediastinum was obtained in 3 mm slice thickness. The CT scan images were transferred to the Eclipse Treatment Planning System (Version 13).

The images were imported and the GTV (gross tumor volumes), CTV (clinical target volumes, comprising of CTV primary and the nodal volumes) were contoured in axial images. A PTV expansion of the CTV was created. The various organs at risk were delineated on the planning CT according to previously published delineation guidelines.

The patient images and contours were then given to the physicists for radiotherapy planning. A dose of 66 Gy in 2 Gy / # was prescribed to the GTV, 60 Gy in 1.8 Gy /# was prescribed to the PTV. The normal tissue constraints were according to the primary tumor. The patients were routinely followed– up for the symptoms of dry mouth or skin reaction during treatment. The grading of the symptoms of Xerostomia/ Dry Mouth was done according to CTCAE Version 4.03. The permission to use the Questionnaire for the study was taken online via e–mail.

CTCAE VERSION 4.03 Dry Mouth Grades

Grade 1: Symptomatic dry or thick saliva without dietary alteration. Unstimulated salivary flow > 0.3 ml/min

Grade 2: Moderate symptoms, oral intake alteration (eg: Copious water, purees, lubricants and soft moist food. Unstimulated salivary flow 0.1– 0.2 ml/min.

Grade 3: Inability to aliment adequately orally. Unstimulated saliva <0.1 ml/min.

The worst grade of dry mouth during treatment was taken as T=0. The patients were evaluated using the same scale at T=3 months follow–up and T=6 months follow–up.

The Quality of Life and toxicity profiles were assessed by Quality of Life Questionnaire (EORTC Version 3.0 QLQ C–30 and H&N–35) at the end of treatment, 3 months follow–up and 6 months follow–up. The patients` response was further statistically evaluated for the secondary objective of the study.

Statistical Analysis

- All continuous variables were expressed as mean +/– standard deviation.All categorical variables were expressed as percentage.
- Comparison of continuous variables were done by independent sample t–test if they were normally distributed, otherwise Mann Whitney U test was used. Spearman rank correlation coefficient was computed to know the association between the ordinal variables. Friedman's ANOVA was used to compare intra group differences at various time intervals.
- Comparison of categorical variables was done using Chi–square test or Fishers exact test.
- Data entry was done in MS Excel Spread sheet. Data analysis was carried out by SPSS version 25.0.
- All p values less than 0.05 was considered as statistically significant.

Results

A total of 80 patients were assigned into IMRT arm and VMAT arm. All patients completed the follow–up at 0, 3 and 6 months and there was complete adherence to the EORTC Questionnaire. There were no significant differences in the base – line characteristics of the patients between the treatment arms.

In the IMRT Group, 22 males and 18 females were enrolled and observed. Among these, most males were in the age group of 61–70 years and most females were in the age group of 51–60 years [Figure 1]. In the VMAT group, 28 males and 12 females were observed. Among these, most males were in the age group of 61–70 years of age, and most females were in the age group of 61–70 years and 71–80 years [Figure 2]. In the IMRT Group, it was observed that the most common diagnosis was that of carcinoma oral cavity (22 out of 40 patients (55%)) while in the VMAT group, the most common diagnosis was carcinoma oropharynx (15 out of 40(40%)).

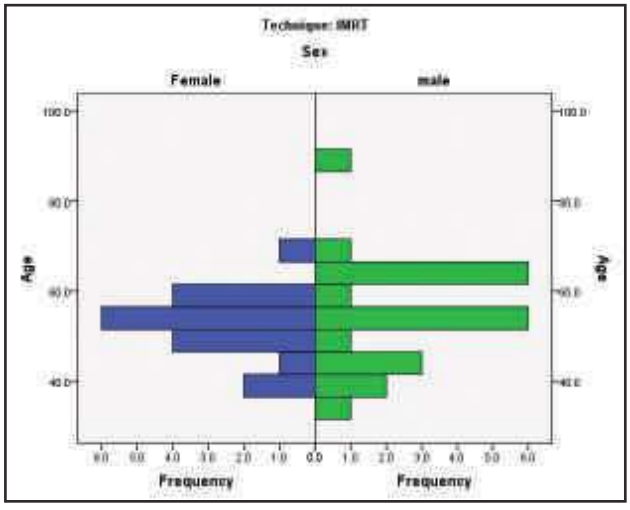

Figure 1. Age and Sex Distribution of patients in the IMRT Group

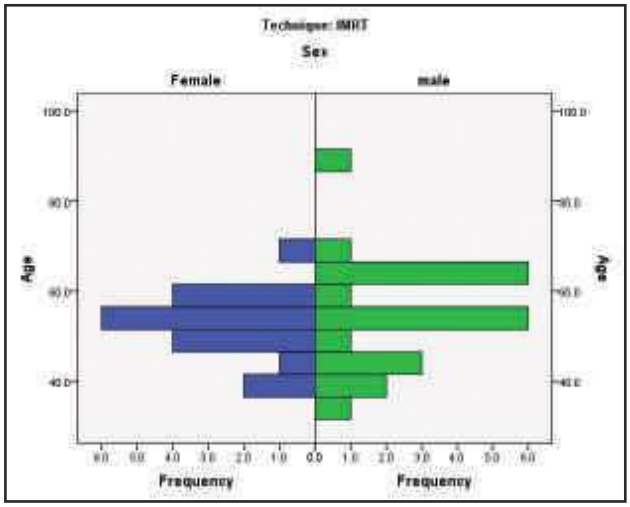

Figure 2. Age and Sex Distribution of patients in the VMAT group

It was observed that in the IMRT Group, at 0 months, 10 patients were having grade 1 xerostomia, 22 patients had grade 2 xerostomia and 8 patients had grade 3 xerostomia. In the VMAT group, 9 patients had grade 1 xerostomia, 23 patients had grade 2 xerostomia, and 8 patients had grade 3 xerostomia. At 3 months, in the IMRT Group, 33 patients were having grade 1 xerostomia and 7 patients had grade 2 xerostomia. None of the patients had grade 3 xerostomia. In the VMAT group, 37 patients had grade 1 xerostomia, 3 patients had grade 2 xerostomia, and no patients had grade 3 xerostomia. At 6 months, in the IMRT Group, 39 patients were having grade 1 xerostomia and 1 patient had grade 2 xerostomia. None of the patients had grade 3 xerostomia. In the VMAT group, 37 patients had grade 1 xerostomia, 3 patients had grade 2 xerostomia, and no patients had grade 3 xerostomia [Table 1].

No significant difference was found between the two groups at 0, 3 and 6 months. However, inside both groups, from 0 to 3 months, the change was found to be statistically significant on applying the Fisher exact test ($p = 0.006$ and <0.001 respectively). Differences inside the groups from 3 to 6 months were not significant in either of the two groups. There were no significant age group or gender–based differences between or inside the two groups at 0, 3 and 6 months.

It was observed that within both the groups, there was significant improvement in the quality of life from 0 to 6 months. Scores of all the troublesome symptoms and quality problems had gone down significantly from 0 to 6 months whereas the scores of all the types of functioning had significantly increased from 0 to 6 months [Table 2].

It was observed that there was no significant difference observed between the two groups of treatment with respect to the quality of life indicating that both therapies were effective in improving the quality of life but none of them was found to be better than the other significantly when comparison was done among the two treatment groups [Tables 3 and 4].

Technique	Grade	0 months	3 months	6 months
IMRT	Grade 1	10(12%)	33(41%)	39(48%)
	Grade 2	22(27.5%)	7(8%)	1(1.2%)
	Grade 3	8(10%)	0	0
VMAT	Grade 1	9(11%)	37(46%)	37(46%)
	Grade 2	23(29%)	3(3.8%)	3(3.8%)
	Grade 3	8(10%)	0	0

Table 1. Distribution of grades of Xerostomia in IMRT and VMAT group at 0, 3 and 6 months

Section	IMRT at 0 months (mean ranks)	IMRT at 3 months (mean ranks)	IMRT at 6 months (mean ranks)	VMAT at 0 months (mean ranks)	VMAT at 3 months (mean ranks)	VMAT at 6 months (mean ranks)	Intra group p value– IMRT	Intra group p value– VMAT
Physical functioning	1.54	2.08	2.39	1.50	2.13	2.38	<0.001	<0.001
Role functioning	1.6	1.96	2.44	1.54	2.03	2.43	<0.001	<0.001
Dyspnea	2.35	1.98	1.68	2.43	1.91	1.66	<0.001	<0.001
Pain	2.94	1.74	1.33	2.81	1.66	1.33	<0.001	<0.001
Fatigue	2.48	2.06	1.46	2.59	2.08	1.34	<0.001	<0.001
Insomnia	2.31	1.86	1.83	2.31	1.86	1.83	<0.001	<0.001
Appetite loss	2.41	1.81	1.78	2.44	1.80	1.76	<0.001	<0.001
Nausea and Vomiting	2.83	1.86	1.31	2.78	1.84	1.39	<0.001	<0.001
Constipation	2.39	1.96	1.65	2.46	1.85	1.69	<0.001	<0.001
Diarrhea	2.59	2.09	1.33	2.60	2.06	1.34	<0.001	<0.001
Cognitive Functioning	1.60	2.20	2.20	1.45	2.25	2.30	<0.001	<0.001
Emotional functioning	1.53	1.94	2.54	1.39	2.01	2.60	<0.001	<0.001
Social functioning	1.56	2.00	2.44	1.54	1.99	2.48	<0.001	<0.001
Financial Difficulties	2.35	1.86	1.79	2.53	1.76	1.71	<0.001	<0.001
Global Health	1.13	2.38	2.50	1.15	2.28	2.58	<0.001	<0.001
Pain	2.71	2.09	1.20	2.66	2.13	1.21	<0.001	<0.001
Swallowing	1.63	2.31	2.06	1.49	2.40	2.11	<0.001	<0.001
Teeth	1.39	2.23	2.39	1.51	2.19	2.30	<0.001	<0.001
Opening mouth	1.39	2.26	2.35	1.44	2.21	2.35	<0.001	<0.001
Dry mouth	1.43	2.29	2.29	1.51	2.18	2.31	<0.001	<0.001
Sticky saliva	1.49	2.16	2.35	1.54	2.20	2.26	<0.001	<0.001
Senses problems	2.58	1.80	1.63	2.56	1.84	1.60	<0.001	<0.001
Coughing	2.54	1.99	1.48	2.63	1.85	1.53	<0.001	<0.001
Felt Ill	2.69	2.01	1.30	2.53	2.04	1.44	<0.001	<0.001
Trouble with Social Eating	2.14	2.73	1.14	2.28	2.68	1.05	<0.001	<0.001
Speech Problems	2.46	2.39	1.15	2.55	2.34	1.11	<0.001	<0.001
Trouble with social contact	2.80	1.79	1.41	2.85	1.78	1.38	<0.001	<0.001
Less sexuality	2.30	2.20	1.50	2.26	2.14	1.60	<0.001	<0.001
Pain Killers	2.30	2.19	1.51	2.29	2.14	1.58	<0.001	<0.001
Nutritional	1.84	2.18	1.99	2.06	2.06	1.88	<0.001	<0.001
Feeding Tube	2.08	1.90	1.83	2.26	1.89	1.85	<0.001	<0.001
Weight Loss	2.83	1.59	1.59	2.83	1.55	1.63	<0.001	<0.001
Weight Gain	1.13	2.44	2.44	1.18	2.45	2.38	<0.001	<0.001

Table 2. Quality of Life Assessment and comparison within both groups (N= 80, Friedman's ANOVA test)

	IMRT at 0 months (mean score)	IMRT at 3 months (mean score)	IMRT at 6 months (mean score)	VMAT at 0 months (mean score)	VMAT at 3 months (mean score)	VMAT at 6 months (mean score)	Inter Group p value at 0	Inter group p value at 3 months	Inter group p value at 6 months
Physical functioning	58.33	65.50	68.67	62.17	69.67	71.67	0.53	0.316	0.49
Role functioning	54.17	59.17	74.17	55.42	62.50	74.17	0.968	0.725	1.00
Dyspnea	41.67	33.33	25.83	44.17	32.50	24.17	0.456	0.712	0.75
Pain	45.42	28.33	22.08	44.58	30.83	23.75	0.823	0.540	0.714
Fatigue	44.17	35.83	26.94	47.78	37.78	24.72	0.391	0.724	0.259
Insomnia	44.17	24.17	22.50	42.50	22.50	20.83	0.761	0.657	0.641
Appetite loss	47.50	34.17	32.50	46.67	32.50	30.83	0.966	0.411	0.308
Nausea and Vomiting	48.75	33.33	23.75	44.17	30.00	22.92	0.367	0.453	0.732
Constipation	44.17	31.67	23.33	47.50	30.83	26.67	0.482	0.646	0.335
Diarrhea	50.00	32.50	12.50	50.83	31.67	11.67	0.803	0.559	0.822
Cognitive Functioning	57.50	68.33	68.33	55.83	69.58	70.83	0.451	0.652	0.288
Emotional functioning	58.33	61.88	71.25	53.75	60.21	68.13	0.406	0.864	0.203
Social functioning	54.58	61.67	67.08	53.75	61.25	67.92	0.659	0.459	0.956
Financial Difficulties	42.50	31.67	30.00	50.83	33.33	30.00	0.109	0.546	0.833
Global Health	57.92	67.29	68.54	55.83	66.04	68.33	0.517	0.426	0.884
Pain	52.08	41.67	25.42	52.29	41.46	25.21	0.984	0.972	0.870
Swallowing	51.88	47.71	45.21	56.25	51.04	46.88	0.319	0.218	0.462
Teeth	48.33	67.50	71.67	55.83	71.67	75.00	0.178	0.196	0.474
Opening mouth	48.33	68.33	70.83	47.50	65.00	70.00	0.897	0.96	0.723
Dry mouth	50.83	71.67	71.67	54.17	70.83	74.17	0.483	0.974	0.32
Sticky saliva	52.00	68.33	73.33	55.00	70.83	72.50	0.736	0.238	0.958
Senses problems	52.08	42.92	39.17	53.75	44.17	40.42	0.960	0.909	0.767
Coughing	48.33	33.33	20.83	54.17	32.50	22.50	0.13	0.317	0.641
Felt Ill	51.67	35.00	19.17	53.33	37.50	20.83	0.881	0.806	0.650
Trouble with Social Eating	48.54	52.50	36.25	50.42	53.33	36.25	0.634	0.529	0.143
Speech Problems	49.44	48.06	37.50	50.83	47.50	35.83	0.720	0.992	0.637
Trouble with social contact	48.83	41.33	35.50	50.17	41.67	36.00	0.597	0.824	0.749
Less sexuality	45.83	42.50	34.58	48.75	42.08	35.42	0.526	0.992	0.817
Pain Killers	97.50	90.00	42.50	97.50	87.50	50.00	1.00	0.725	0.656
Nutritional suppliments	57.50	80.00	67.50	87.50	87.50	75.00	0.003	0.366	0.461
Feeding Tube	55.00	30.00	25.00	57.50	32.50	30.00	0.823	0.811	0.619
Weight Loss	90.00	7.50	7.50	97.50	12.50	17.50	0.169	0.459	0.179
Weight Gain	5.00	92.50	92.50	2.50	87.50	82.50	0.559	0.459	0.179

Table 3. Quality of Life Assessment and comparison between both groups (N= 80, Mann Whitney test)

Section	Inter group p value at 0 months	Inter group p value at 3 months	Inter group p value at 6 months
Physical functioning	0.53	0.316	0.49
Role functioning	0.968	0.725	1.00
Dyspnea	0.456	0.712	0.75
Pain	0.823	0.540	0.714
Fatigue	0.391	0.724	0.259
Insomnia	0.761	0.657	0.641
Appetite loss	0.966	0.411	0.308
Nausea and Vomiting	0.367	0.453	0.732
Constipation	0.482	0.646	0.335
Diarrhea	0.803	0.559	0.822
Cognitive functioning	0.451	0.652	0.288
Emotional functioning	0.406	0.864	0.203
Social functioning	0.659	0.459	0.956
Financial Difficulties	0.109	0.546	0.833
Global Health	0.517	0.426	0.884
Pain	0.984	0.972	0.870
Swallowing	0.319	0.218	0.462
Teeth	0.178	0.196	0.474
Opening mouth	0.897	0.96	0.723
Dry mouth	0.483	0.974	0.32
Sticky saliva	0.736	0.238	0.958
Senses problems	0.960	0.909	0.767
Coughing	0.13	0.317	0.641
Felt Ill	0.881	0.806	0.650
Trouble with Social Eating	0.634	0.529	0.143
Speech Problems	0.720	0.992	0.637
Trouble with social contact	0.597	0.824	0.749
Less sexuality	0.526	0.992	0.817
Pain Killers	1.00	0.725	0.656
Nutritional	0.003	0.366	0.461
Feeding Tube	0.823	0.811	0.619
Weight Loss	0.169	0.459	0.179
Weight Gain	0.559	0.459	0.179

Table 4. Quality of life assessment and comparison between both groups (N=80, Mann Whitney Test)

Discussion

A notable difficulty with irradiation of head–and–neck cancer is the large number of organs at risk in close proximity to the target, including the salivary glands. This results in severe consequences for the quality of life of these patients[14]. Introduction of intensity–modulated radiation therapy technique for the treatment of HNC replaced conventional and 3D–conformal radiation therapy techniques, which resulted in much better dose conformity and sparing of the OARs and, therefore, less radiation–induced toxicity[11]. There are not many studies comparing IMRT and VMAT directly in terms of local side effects and quality of life for head and neck cancers in India.

Comparison of Grade of Xerostomia

No significant difference was found in the grades of xerostomia between the two groups at 0, 3 and 6 months. However, inside both groups, from 0 to 3 months, the change was found to be statistically significant. Differences inside the groups from 3 to 6 months were not significant in either of the two groups.

The study done by Holt et al suggests that using VMAT planning, the doses to the contralateral Parotid glands may be brought down by almost 2– 2.5 Gys[15]. This dose difference is not significant enough to translate into direct benefit in terms of Dry Mouth complaints that the patients present with, after Radiotherapy. Study by Dijkema et al suggests that the saliva is contributed by major and minor salivary glands including the Sub–mandibular glands. However, these structures (minor salivary gland and sub–mandibular glands) are not considered as OAR`s in our Radiotherapy practice[2].

Comparison of Quality of Life

It was observed that within both the groups, there was significant improvement in the quality of life from 0 to 6 months. Scores of all the symptom scale related fields had gone down significantly from 0 to 6 months whereas the scores for all Function scales had significantly increased from 0 to 6 months.

The EORTC measures were used as they link the roles of disease–specific and global QoL scales. The broad measures revealed that QoL in general was impaired predominantly in the early period after IMRT and VMAT treatments and continually improved over time in both groups.

Significant improvements were seen within both groups with respect to physical, role, cognitive and emotional function at 0, 3 and 6 months. Whereas with respect to symptom scores, the two groups were similar

in terms of patients` evaluation of his/ her own condition and both groups showed similar improvement in terms of QoL scores at 3rd and 6th month follow–up.

It was observed that there was no significant difference observed between the two groups of treatment with respect to the quality of life indicating that both therapies were effective in improving the quality of life but none of them was found to be better than the other significantly when comparison was done among the two treatment groups.

Huang et al studied quality of life and survival outcome for patients with nasopharyngeal carcinoma treated by volumetric–modulated arc therapy versus intensity–modulated radiotherapy and concluded that there was no statistically or clinically significant difference in all the QoL scales between VMAT and IMRT group at each time point[16]. The study results are similar to the study by Huang et al.

In the study by Lu et al, they compared the dosimetric outcome between the planning of VMAT and IMRT using the same NPC patients and observed a statistically significant reduction (from 31.3 Gy to 26.3 Gy) of the mean dose to parotids[17]. The result could not be repeated in similar studies reported by Jin et al[18]or Lee et al [19].

The study had some limitations. The follow–up period was 6 months. This follow–up period is relatively short to completely assess the outcomes of Dry Mouth as well as assessing the quality of life differences. Similar studies have been done in the past with a follow–up of 1–2 years.

Pow et al (2006) compared IMRT and conventional Radiotherapy in patients of Nasopharyngeal carcinoma and compared their salivary flow and quality of life. Their stimulated whole (SWS) and parotid (SPS) saliva flow were measured. The EORTC quality of life Questionnaire was filled by the subjects at baseline and 2 months, 6 months and 12 months after completion of Radiotherapy. IMRT was significantly better than CRT in terms of parotid sparing and improved QoL for early–stage disease[5].

Bjordal et al (2000) conducted a field study of EORTC QLQC–30 and H&N 35 in head and neck cancers. The sample size was 622 and they came from 12 different countries. The follow–up time was between 1 to 3.5 years in this study. The QLQ–H&N35 was found to be sensitive to differences between disease status, disease site and patients with different performance status, and to changes over time. The new physical functioning scale of version 3.0 of the QLQ–C30 was shown to be more reliable than previous versions. Thus, the QLQ–H&N35, in conjunction with the QLQ–C30, appears to be reliable, valid and applicable to varied samples of head and neck cancer patients[20].Besides, a sample size of 80 patients may not be large enough to detect a small difference in xerostomia and QoL amongst the IMRT and VMAT arm. The study population was heterogeneous and the VMAT arm had a higher number of subjects in the age group of 60– 80 years (IMRT 11, VMAT 29). This age difference can cause the data to be skewed in favour of IMRT as the improvement in the quality of life over 6 months after treatment, depends on the patient population.

Conclusion

We enrolled 80 patients of head and neck cancer in our study who were being treated by concurrent chemo–radiation by either VMAT or IMRT technique, 40 patients in each arm. The patients were followed up during treatment and at 3 months and 6 months after finishing treatment for symptoms of Dry Mouth and a QoL Questionnaire was used to assess their quality of life.

The primary objective was to assess the degree of xerostomia in VMAT Vs. IMRT and there was no statistical difference in the severity of Xerostomia in terms of Grade of Dry Mouth at 0(worst Dry Mouth Grade/ Dry mouth grade in the last week of treatment), 3rd and 6th months post radiotherapy. This can be due to similar doses delivered to bilateral parotid glands. The two groups had similar Quality of Life scores on evaluation by EORTC Questionnaire at 0, 3 and 6 months. The self–reported questionnaire revealed that the patients in two arms had improved significantly over 6 months but there was no statistical difference between the 2 groups.

Therefore, it can be concluded that IMRT and VMAT are almost similar in terms of treatment related toxicity as far as Dry Mouth is concerned. There is no statistically significant difference between the two treatment arms in terms of treatment related xerostomia and quality of life. Both the treatments were comparable in terms of toxicity and quality of Life. A longer period of follow– up upto two years may show a benefit of VMAT over IMRT.

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Nil

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