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DMF-T index in patients undergoing radiation therapy with LINAC X-ray radiation for head and neck cancer at Department of Radiotherapy, Dr. Hasan Sadikin Hospital

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ABSTRACT

Radiation therapy for head and neck cancer frequently caused severe salivary gland dysfunction. The salivary gland dysfunction possibly decreased the protective function of saliva and caused dental caries. The purpose of this study was to obtain an illustration about DMF-T index in patient undergoing radiation therapy with LINAC X-ray radiation for head and neck cancer at Department of Radiotherapy, Dr. Hasan Sadikin Hospital in January-February 2007. The study was a simple descriptive. The study was conducted on 7 males and 9 females undergoing radiation therapy with LINAC X-ray radiation for head and neck cancer. The ages of patient are between 37 years and 77 years. The severity of caries was measured by DMF-T index. DMF-T index in 16 patient undergoing radiation therapy with LINAC X-ray radiation for head and neck cancer at Dr. Hasan Sadikin Hospital is 10.6 as the result of this study. The conclusion of this study showed that the DMF-T index in 16 patient undergoing radiation therapy with LINAC X-ray radiation for head and neck cancer at Dr. Hasan Sadikin Hospital had very high grade based on WHO classification, which the value was over 6.6.

Key words: Caries index, head and neck cancer, LINAC X-ray radiation

INTRODUCTION

Radiotherapy means a medication using radioactive light. This kind of medication has been initiated over a hundred years ago. In its development, ionizing radiation of photon type (γ ray and X-ray) is used for medication therapy of cancer.

Radiotherapy is a method of medicating serious illnesses using ionizing light. The principle is the lighting process with maximum dosage that can be tolerated by normal tissues. Lethal dosage and the ability of repairing damaged cancer cells are lower than normal cells, so as the result, cancer cells will be eliminated more comparing to normal cells.[1,2] Radiotherapy can cause some damages or side effects in healthy tissues. If oral and saliva gland are radiated in high dosage, some side effects will occur, such as hyposalivation, mucositic, taste loss, effects on teeth and periodontal tissues, trismus, and osteoradionecrosis.[3,4]

Radiotherapy is one of many ways, else than surgery and chemotherapy, that can be used in medicating some ferocious tumors in neck and head areas. Choosing and determining kind of treatment is conducted with profound considerations on tumor's location, extension,

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size, regional limp gland and bone involvements, physical and mental status, patient's will, and potential complication that may be occurred in each therapy.

Saliva gland possesses radiosensitive nature due to its structure that consists of mucosa and serosa. Histologically, the first radiation therapy may cause an acute inflammation on serosa acinus cells, and after several months it may lead to a chronic inflammation, progressive fibrosis, adipose, veins damage and parenchyma cells degeneration. Radiation is also able to alternate saliva composition. Saliva turns out to be thick, and the color is changed into white, yellow, and brownish, and also there will be protein and electrolyte abnormality, buffer capacity disorder, and induction in saliva pH.

Those damages can cause induction in saliva gland function; in fact saliva plays a great role in protecting teeth in oral area. Induction in saliva volume to below 0.7 ml/minute can cause a decreasing in saliva pH which will enhance caries risk. The sudden decreasing of saliva flow due to radiation will create rampant caries. Rampant caries is the description of teeth damage that happens so fast and suddenly, and it usually involves teeth surface with no caries.

A study indicated that odontoblas was sensitive to radiation, and might cause disorganization in odontoblas or even in dentin tissue. There was also atropic alteration in pulp tissue followed by pulp necrosis process. Another study stated that radiation had an effect on cariogenic microflora population. It was also reported that *Streptococcus mutans* population before radiation is 1.6%, and had a steep increase to 43.8% after radiation.

A study on caries in post radiation patients aged 2 month to 6 years showed that all patients possessed caries radiation but the starting time of the caries was unnoticed. Another study stated that email demineralization in patients with radiotherapy could be seen after a 6 week radiotherapy treatment.

Saliva has two general physiology functions, to protect soft and hard tissues in oral area. The forms of the protection are buffering, self cleansing actions and also as antimicrobacteria.[5] Saliva has anticaries nature. If the amount of saliva that comes out from saliva gland reduces, the saliva components quantity such as electrolyte and saliva immunoprotein which usually help protecting teeth from caries are also reduces.[6,7]

Radiation also causes Na^+ pump disorder and Ca^{2+} concentration reduction. These disorders create an alteration in ions organization process in cells that makes saliva secretion reduction. Radiation may also cause a change in saliva quality, that is saliva pH reduction. This process of acidity change is related to saliva flow speed and buffer capacity in saliva. Saliva flow speed decreases as the result of radiation can cause damages on saliva gland ductus. This leads to the reduction of HCO_3^- and then followed by saliva pH reduction.

Radiation causes some changes in oral microflora structure. Cariogenic microorganisms such as *Streptococcus mutans* and *Lactobacillus* increase. *Candida albicans* increases as well. The acid produced by those microorganisms will reduce local pH to the level that may cause teeth demineralization. Demineralization process is in line with remineralization process. When demineralization and remineralization processes are not balanced due to many factors as the result of oral radiation, some changes in email will occur. Those factors are hyposalivation, hypersensitivity effect on teeth, and dentino enamel junction damage, taste loss and mucositic.

Based on the explanation, the writer was interested in studying teeth caries description in patients with X-ray radiation therapy of neck and head cancers.

MATERIALS AND METHODS

This research used descriptive method which means this research aimed at making a description on a phenomena whether it was in form of risk factor or effect factor and the result of the reseacrh was reported as it was. The population of this research were patients of neck and head cancers with LINAC X-ray radiation therapy in RSUP Dokter Hasan Sadikin.

The samples of the research were patients of neck and head cancers with LINAC X-ray radiation therapy in Department of Radiology Dr. Hasan Sadikin Hospital in January-February 2007. Sample collection technique used was incidental

sampling which means getting the data of the samples incidentally or by accident.

Explanation about the research was given and patients filled in the informed consent comprised name, age, sex, address, and occupation. Patients were ordered to sit and gargled to diminish foods that still left in oral areas. The researcher conducted an examination on teeth's hard tissue, and recorded the result, how many teeth that were included in the D, M or F criteria. The result was measured using the DMF-T index.

RESULTS

The research on 16 patients of neck and head cancers with LINAC X-ray radiation therapy was conducted by checking clinical condition of teeth tissue in order to get the DMF-T index. The result of the research comprised the DMF score, age, sex, and the samples' medical record (Tab. 1).

Based on Table 1, it can be seen that the samples' age were varied. Generally, there were 14 samples aged 40 years old, and the rest 2 samples aged below 40 years old. Male samples were 9 and females were 7. Kinds of cancers which was the most dominant was nasopharynx carcinoma in 12 samples, 3 samples with tongue carcinoma and 1 sample with parotis carcinoma.

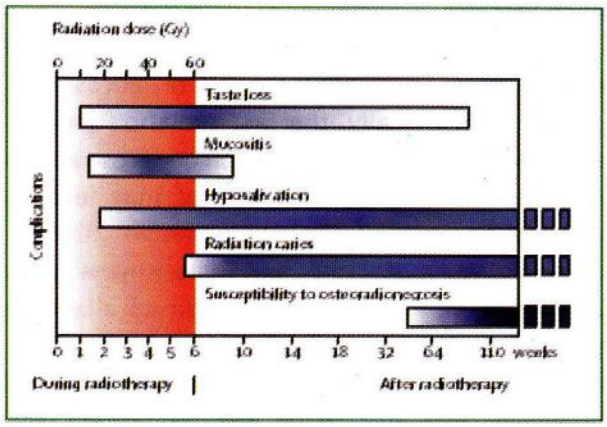

Figure 1. Side effect of radiotheraphy in the mouth based on timing, duration, and dosage.

Tabel 2. WHO Index classification of DMF-T based on severity level.

Severity level	DMF-T index
Very low	0.0-1.1
Low	1.2-2.6
Moderate	2.7-4.4
High	4.5-6.5
Very high	>6.6

Table 1. The DMF score of patients of neck and head cancers with LINAC X-ray radiation therapy.

No	Age (year)	Sex	Diagnose	Stadium	Irradiating	Total	D	M	F	DMF
1	51	L	NC	T3N2MO	1x	3	10	1	-	11
2	38	L	NC	T3N1MO	2x	3	1	-	-	1
3	66	P	Ca Tongue		4x	1	6	14	-	20
4	54	P	NC	T2N1MO	10x	3	-	-	3	3
5	44	P	NC	T4N0MO	10x	3	5	-	-	5
6	56	P	NC	T4N2MO	11x	3	3	3	-	6
7	56	L	Ca Parotis		14x	1	4	3	4	7
8	49	L	NC	T2N3MO	19x	3	7	10	-	21
9	46	L	NC	T4N3MO	19x	3	5	15	-	20
10	37	L	Ca Tongue		19x	2	1	-	-	1
11	77	P	Ca Tongue	T2N0MO	22x	2	1	15	-	16
12	44	L	NC	T3N2MO	23x	4	4	2	-	6
13	47	L	NC	T2N0MO	24x	2	2	4	5	11
14	53	L	NC	T3N2MO	26x	3	3	8	-	11
15	41	P	NC	T2N2MO	27x	3	1	7	2	10
16	46	P	NC	T4N3MO	39x	3	6	15	-	21
			Total				59	97	14	170

NC: Nasopharynx carcinoma

The highest cancer stadium were in samples no. 9 and 16 while the lowest were in samples no. 11 and 13. The numbers of irradiating were varied, the fewest was once (no. 1) and the most was 39 times (no. 16). The highest numbers of radiation fields was 4 radiation fields (no. 12) and the lowest was 1 radiation field (no. 3 and 7).

The biggest DMF score was 21 (no. 8 and 16) and the smallest was 1 (no. 2 and 10). Based on the DMF-T index formulation, the DMF-T index score was 10.6. Table 2. on the DMF-T classification index based on the severity level according to WHO, the DMF-T index was included to a very high classification, that was above 6.6.

DISCUSSION

Based on the result, the DMF-T index of radiotherapy patients of neck and head cancers in RSUP Dr. Hasan Sadikin was high eventhough the numbers of DMF teeth in each sample was varied. Overall the condition of patients' oral hygiene was bad.

Generally, patients' oral hygiene conditions before undergoing radiotherapy had already bad. It was proven by so many missing teeth on the previous dental treatment before having radiotherapy treatment. Teeth pulling out by bad prognosis was the treatment that had to be conducted when patients did not have any motivations to keep oral hygiene.[8] Most patients complained having difficulty in cleaning oral area because of the mass of tumor size. This condition even made patients hard to open their mouth. There were also some patients that had bad habit in keeping oral hygiene, such as never brushed their teeth before going to bed, smoking, even hardly saw dentist unless they felt extreme pain.

Based on the information got from patients, most of them had some pains in oral areas during radiotherapy. The more radiation, the more pains they felt in their oral areas. In the beginning, they felt pain, then they started hard to speak, and difficult to swallow foods. These pains got worse as the dosage given increased. This condition occurred due to the abnormal saliva production reduction, which is known as xerostomia. Xerostomia is a radiotherapy side effect that occurs as the result of saliva gland damage because of radiation.[9]

Xerostomia would eventually give an effect on patients' oral hygiene during radiotherapy. Saliva's function as oral cleaner reduced, pH and saliva buffer function also reduced, and there was also reduction of immunoprotein in saliva that increased the number of microorganisms which caused caries.[3] Besides xerostomia, patients also complained about ulcer and pain on teeth during radiotherapy. Radiotherapy could cause mucositis and hypersensitive teeth that influenced oral hygiene, and this made patients had difficulty in cleaning their oral areas mechanically.[3] Bad oral hygiene would trigger caries occurred earlier.

Based on the result described in Table 2, the DMF scores were classified into the worst severity level in three groups, they were low, medium, high, and extremely high levels, and a group with the most DMF score of all samples.

Patients no. 2,4,10 was in the group with low to medium DMF scores. Based on the result, there were no radiation caries symptoms in these three patients. The three of them had just undergone radiotherapy for less than a month. Based on this information, the three patients had good habit in keeping oral hygiene. Dental treatment they underwent before radiotherapy was scalling treatment, and there were no teeth pulling out.

Patients no. 1,5-7,12-15 were in the group with high level to extreme level caries. Some patients in this group had undergone radiotherapy for more than a month; the patients that had come to the 6th week of radiotherapy were patients no. 14 and 15. In oral checking on both patients, there were some symptoms of early radiation caries. In some areas, the color of teeth email turned out to be fairer, but there had not been any caries because of radiation. The caries found was in pit and fissure areas.

Patients no. 3,8,9,11, and 16 were in the group with the highest DMF scores of all samples. Eventhough the radiation recieved by these 5 patients was varied, they generally showed the symptoms of radiation caries. Sample no. 16 was the sample with the highest DMF score. In this patient there was found radiation clinical caries known as dentin caries in incisal incisive teeth of lower jaw. This was in line with the statement that radiation caries occurred after 6 week

radiotherapy treatment and when patients got total dosage for more that 60 Gy.[3]

The DMF score of sample no. 3 was also high; in fact the patients had just undergone radiation for 4 times. Based on the information, the patient had ever in radiotherapy treatment a year ago. In patient no. 11 there was found radiation clinical caries with root remains which was included to missing criteria, the numbers of missing teeth in this patients were 15. The symptoms of radiation clinical caries was dentin caries in incisal incisive teeth of lower jaw was also found in patient no. 8.

The severity condition caries level in this sample group was not only influenced by other factors else than radiation, primarily in samples with radiotherapy treatment that had not been into the 6th week. In patient no. 11 for instance, age factor also played a role in causing teeth missing. Age factor influenced tissue regeneration process. Young aged patients would be easier in tissue repairing compared to older patients.[10]

Patients no. 8 and 9 had the highest DMF score as well. Based on the information, both patients had bad habit in keeping their oral hygienes. Before undergoing radiotherapy, the patients were active smokers and they never brushed their teeth before going to bed. Patient no. 9 was the sample with higher cancer stadium compared to the other samples. The stadium of a cancer had an influence on patients' abilities in cleaning their oral areas. In this case, a significant stadium level was related to the size of tumor mass (T).

Based on the research, generally patients that had just undergone radiotherapy treatment or still had tumor mass that had not reduced in size would be difficult to be examined because they had difficulties in opening their mouth. Patients were also complained about their difficulties in speaking and cleaning their oral areas.

If the calculation of DMF-T index score was conducted to each male and female patient, the result was, male's DMF-T index was higher than female's. The DMF-T index in male was 9.89 and in female was 9. This was in line with the survey result on oral hygiene of human population in America which showed that females brushed their teeth and visited dentist more often than males.[11]

Based on those samples, it can be described the causes of DMF score variations in each patient. Eventhough in overall the DMF-T index was high, generally the DMF score of each patient did not show any relation to the amount of dosage and radiation received by them. Caries that occurred in radiotherapy patients were not only the indirect side effect of radiation but also the direct side effect of radiation.[3]

CONCLUSION

Based on the research, the conclusion can be drawn that the DMF-T index of 16 patients of neck and head cancers with LINAC X-Ray radiation therapy in Dr. Hasan Sadikin Hospital was 10.6. The result is classified in extremely high group based on the DMF-T index classification of WHO according to the severity level that is above 6.6.

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