

Original Research Article

Dental Caries among a Group of Children Receiving Radiotherapy in Medical City, Baghdad

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Abstract: *Background:* Radiation treatment is frequently utilized in management of head and neck cancer (HNC). This technique uses ionizing radiation to target specific cancer cells, either by directly destroying their genetic material or by causing them to produce free radicals, which ultimately kill the cells. *Objective:* To assess dental caries, oral hygiene and gingival health condition among children with (HNC) after receiving radiotherapy. *Methods:* The total sample composed of 100 children with HNC aged 2 years and above attending to Medical City in Baghdad, Iraq for their regular followup and treatment, were selected randomly for the study. *Results:* The entire group of children (HNC) was caries-active. According to gender, males had the higher mean value (dmfs\DMFS) with significant differences. Regarding to age both (dmfs\DMFS) mean values was higher at age ≥ 8 years with highly significant difference only for dmfs value. The mean difference of (PII, GI) indices for each gender was significant. The correlation between PI, GI, indices and dmfs was significant with positively correlated. *Conclusions:* Comprehensive oral health education and preventative measures are vital for enhancing oral health conditions.

Keywords: Head and Neck Oncology, Radiation, Dental Caries.

INTRODUCTION

Radiotherapy is frequently administered to patients with head and neck cancer, and its adverse effects on oral structures can be both direct and indirect. These effects may manifest acutely or chronically in the oral cavity, comprising oral mucositis, taste disturbances, leukocytopenia, and osteoradionecrosis [1]. A fast and aggressive carious process called radiation caries may start in patients who have been exposed to radiation, increasing their risk of complications [2-4]. The pulp may be quickly affected by caries that worsens along the cervical and incisal borders of teeth if left untreated [5].

A correlation exists between radiotherapy and the breakdown of hard tissues, including teeth [1]. The association between radiotherapy and an increased risk of dental caries remains contentious. Research indicates that dental caries prevalence escalates post-radiotherapy, as the treatment diminishes the oral cavity's self-cleaning ability due to the impairment of salivary gland function, resulting in xerostomia [6]. Another study indicated that direct injury to the tooth by radiotherapy heightened the likelihood of caries [7]. This research is to assess dental caries, hygiene, and gingival health in children receiving irradiation to formulate preventative dental methods for radiation-induced progressive caries.

MATERIALS AND METHODS

The work in this research began in November 2021 and will continue until February 2023. The entire sample consists of 100 children (53 females and 47 males) with HNC (clinically examined at Medical City in Baghdad province, Iraq) aged 2 and up. The patients were chosen based on the kind of disease (head and neck cancer) and duration of therapy (after 6 months of radiation). Dental caries were detected through clinical examination with a dental mirror and explorer. Caries experience was assessed and recorded using decayed, missing, and filled teeth and surfaces indices (DMFS) based

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on WHO guidelines (WHO, 1997). The Silness-Löe plaque index (PII) [8], and Ramfjord's calculus index (Call) [9], were used to assess oral health. The Löe and Silness Gingival Index (GI) [10], was used to assess gingival inflammation. Statistical analyses were measured using SPSS version 26 (Statistical Package for Social Sciences). Descriptive measures (mean and standard deviation) and inferential statistics (Student's t-test, ANOVA test) were used. The degree of confidence was 95%. The study was accomplished in Dentistry College Ethical Committee (RIC-PCF-2021-2022\06. Every participant provided informed consent.

RESULTS

The demographic distribution of the sample, including 100 children, indicates that 47% were males and 53% were females, with ages ranging from 2 to 10 years. The age distribution was categorized into three groups: 3 years and under, 4 to 7 years, and 8 years and over, as seen in Table 1.

Table 1: Study sample Frequency distribution by age, gender

		N	%
Age Group (years)	3 and less	5	5
	4-7	50	50
	8 and above	45	45
Gender	Male	47	47
	Female	53	53
Total		100	100

Table 2: The mean difference in PII, GI, and Call according to age

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			Plaque index	Gingival index	Calculus
Age Group	3 and less	Range	1.94	0.87	0.16
		Mean	1.79	0.26	0.03
		SE	0.29	0.17	0.03
		N	5	5	5
	4-7	Range	3	1.8	0.83
		Mean	0.56	0.19	0.05
		SE	0.11	0.06	0.02
		N	50	50	50
	8 and above	Range	2.92	1.8	0.83
		Mean	1.31	0.59	0.04
		SE	0.16	0.11	0.02
		N	45	45	45
	Total	Range	3	1.8	0.83
		Mean	0.96	0.38	0.04
		SE	0.1	0.06	0.01
		N	100	100	100
	Difference ANOVA test		Highly Significant	Highly Significant	Not Significant

Table 3: DMFS and dmfs mean difference by gender, age group

		Dmfs					DMFS				
		Range	Mean	SE	N	P	Range	Mean	SE	N	P
Age Group	3 and less	4	8	0.63	5	Highly Significant	0	0	0.0	5	Not Significant
	4-7	15	9.44	0.48	50		4	1.1	0.23	50	
	8 and above	17	10.71	0.69	45		18	4.79	4.47	45	
Gender	Male	19	10.79	0.68	47	Significant	18	5.04	0.66	47	High Significant
	Female	20	9.19	0.43	53		18	1.06	0.41	53	

Table 4: The mean difference in PII, GI, and Call according to gender

		Plaque index		Gingival index		Calculus
Male	Range	3		1.8		0.2
	Mean	1.28		0.6		0.02
	SE	0.17		0.11		0.01
	N	47		47		47
Female	Range	2.3		1.4		0.83
	Mean	0.67		0.18		0.06

		Plaque index	Gingival index	Calculus
	SE	0.1	0.04	0.03
	N	53	53	53
Difference ANOVA test		Highly Significant	Highly Significant	NS

Table 5: Correlation coefficient between the caries-experience (primary and permanent teeth) and plaque, gingival indices

	dmfs		DMFS	
	r	P	r	P
PI	0.342	0.001**	0.26	0.8
GI	0.517	0.000*	-0.018	0.862

The distribution of genders showed that women were more represented than men. The mean oral hygiene parameters (PII, GI, and Call) difference by age groups is shown in Table 2. Only the differences between PII and GI were determined to be highly significant.

Whereas GI mean difference of represented the largest number at ages 8 and above, the mean difference of PII represented the highest value at age 3 and under. The mean difference in caries experience by age and gender is presented in Table 3. The mean DMFS was greatest for the age group of ≥ 8 years, exhibiting no significant difference, whereas the mean DMFS for all age groups was also highest at ≥ 8 years, demonstrating a highly significant difference. There were statistically significant gender-based differences in DMFS, with males showing the largest mean difference.

Nonetheless, men exhibited the most significant mean difference in dmfs, accompanied by considerable variability. Table 4 indicates a significantly significant mean difference in oral hygiene (PII, GI) between men and females. The greatest mean variation in plaque index, 1.28, was seen in males. Table 5 illustrates the association coefficient between primary and permanent caries experience in teeth, as well as PII and GI in individuals with HNC.

Regarding the primary significant association, PI, GI, and dmfs have been found to be positively associated. There was no significant correlation between DMFS and (PI, GI), while GI was adversely associated.

DISCUSSION

Treatment plans for cancers of the head and neck often include radiation therapy. Additionally, it has a lot of unsavory side effects. Radiation causes fibrosis and atrophy of the muscles used for chewing, which in turn causes trismus and xerostomia, which in turn cause extensive tooth decay and osteoradionecrosis in patients exposed to radiation for an extended period of time [2-11]. Radiotherapy alters dentition, saliva, and oral microbiota. Radiation caries has a multifaceted origin, but hyposalivation is the predominant culprit. The current study's findings revealed that caries experience was higher. Existing investigations on (dmfs \DMFS) have revealed comparable conclusions [6-16]. Other investigations revealed no difference between conventional dental caries and radiation-induced dental caries, as assessed by both microscopic analysis and in vitro research [17]. Multiple variables may be contributing to the increased severity of dental caries. Radiation damage to salivary glands reduces saliva flow rate, resulting in alterations in the oral environment that favor caries-related microorganisms [14-18]. Hyposalivation reduces the saliva's typical preventive qualities, increasing the risk of caries and demineralization.

Furthermore, irradiated patients' diets shift to sticky, softer, and carbohydrate-rich foods with increased frequency of ingestion due to radiation-induced alterations such as atrophy of oral mucous membranes, mucositis, hyposalivation, and taste loss, which promote caries [19-21]. DMFS-based caries prevalence increased with age, with statistically significant differences between age groups. This was supported by the findings of a previous study [22], and may be due to the irreversibility and accumulation of dental caries with increasing age [23-25].

Other studies found no significant difference based on age [6]. The results of this investigation revealed increased mean values of (PII and GI) indices. This may be ascribed to neglect resulting from frequent hospitalizations, psychological factors, or inadequate oral hygiene habits, since most patients indicated a reluctance to wash their teeth due to bleeding and vulnerability to infection.

Prior research indicate that patients undergoing chemotherapy and radiation frequently exhibit inadequate oral hygiene during and post-treatment, although monitored oral hygiene practices and antimicrobial protocols [26-29]. According to the findings of the current study, there is a strong positive correlation coefficient between the presence of caries in primary and permanent teeth, plaque index (PI), and gingival index (GI) among patients diagnosed with head and neck cancer (HNC).

No significant correlations were identified between DMFS and (PI, GI), with a negative association seen between GI and DMFS. Based on the findings of this study, which showed that the average values of the dental plaque index increased, this is because all patients do not practice proper oral hygiene. One of the most important factors in the onset and advancement of gingival disease is dental plaque [30].

Some limitations in this study include the fact that the majority of patients received both chemotherapy and radiotherapy, making it difficult to obtain children who only received radiotherapy, as well as the difficulty of following up with children six months after radiation treatment. Future research should investigate salivary variables and immune factors in relation to oral health status among HNC patients during and after radiotherapy treatment. Furthermore, more longitudinal studies are needed to determine the influence of radiation on oral health conditions in various age groups.

CONCLUSION

Radiotherapy causes degeneration in dentition, saliva, and oral microbiota in HNC patients. These patients exhibited inadequate oral hygiene and a significant prevalence of severe dental caries; hence, extensive oral health preventative and instructional programs were instituted prior to, during, and after radiotherapy. Patient motivation, effective plaque management, stimulation of salivary flow, and fluoride application are essential for reducing the prevalence of radiation-induced caries and enhancing the quality of life for head and neck cancer patients.

REFERENCES

- Aguiar GP, Jham BC, Magalhães CS, Sensi LG, Freire AR. A review of the biological and clinical aspects of radiation caries. *The journal of contemporary dental practice*. 2013;10:83-9.
- Almståhl A, Finizia C, Carlén A, Fagerberg-Mohlin B, Alstad T. Explorative study on mucosal and major salivary secretion rates, caries and plaque microflora in head and neck cancer patients. *International journal of dental hygiene*. 2018;16(4):450-8.
- Al-Rawi NA, Al-Dafaai RR, Sammi M. Effect of chemotherapy on oral health status and salivary alkaline phosphatase among leukemic patients. *Journal of Baghdad College of Dentistry*. 2013;25(Special Is):137-9.
- Al-Rawi NA, editor Oral hygiene and salivary immunoglobulin among acute lymphocytic leukemic patients undergoing chemotherapy courses 2011.
- Al-Tamimi HK, Al-Rawi NA. Effect of ageing on selected salivary chemical compositions and dental caries experience among group of adults. *Journal of Baghdad College of Dentistry*. 2019;31(3):1-9.
- Al-Zaidi RR. Oral Health status in autism patients children in Iraq. *NeuroQuantology*. 2021;19(6):54-60.
- Bäckström I, Funegård U, Andersson I, Franzen L, Johansson I. Dietary intake in head and neck irradiated patients with permanent dry mouth symptoms. *European Journal of Cancer Part B: Oral Oncology*. 1995;31(4):253-7.
- Cahen PM, Turlot JC, Frank RM, Obry-Musset AM. National survey of caries prevalence in 6-15-year-old children in France. *Journal of dental research*. 1989;68(1):64-8.
- Chaloob EK, Qasim AA. Nutritional status in relation to oral health status among patients attending dental hospital. *Journal of Baghdad College of Dentistry*. 2013;25(Special Is):114-9.
- Çubukçu ÇE, Sevinir B. Dental health indices of long-term childhood cancer survivors who had oral supervision during treatment: a case-control study. *Pediatric Hematology and Oncology*. 2008;25(7):638-46.
- Dreizen S, Brown LR, Daly TE, Drane JB. Prevention of xerostomia-related dental caries in irradiated cancer patients. *Journal of dental research*. 1977;56(2):99-104.
- Dreizen S, Daly TE, Drane JB, Brown LR. Oral complications of cancer radiotherapy. *Postgraduate medicine*. 1977;61(2):85-92.
- Fattore L, Rosenstein HE, Fine L. Dental rehabilitation of the patient with severe caries after radiation therapy. *Special Care in Dentistry*. 1986;6(6):258-61.
- Gupta N, Pal M, Rawat S, Grewal MS, Garg H, Chauhan D, et al. Radiation-induced dental caries, prevention and treatment-A systematic review. *National journal of maxillofacial surgery*. 2015;6(2):160-6.
- Hegde AM, Joshi S, Rai K, Shetty S. Evaluation of oral hygiene status, salivary characteristics and dental caries experience in acute lymphoblastic leukemic (ALL) children. *Journal of Clinical Pediatric Dentistry*. 2011;35(3):319-23.
- Javed F, Utreja A, Bello Correa FO, Al-Askar M, Hudieb M, Qayyum F, et al. Oral health status in children with acute lymphoblastic leukemia. *Critical Reviews in Oncology/Hematology*. 2012;83(3):303-9.
- Joyston-Bechal S, Hayes K, Davenport ES, Hardie JM. Caries incidence, mutans streptococci and lactobacilli in irradiated patients during a 12-month preventive programme using chlorhexidine and fluoride. *Caries research*. 1992;26(5):384-90.
- Kielbassa AM, Hinkelbein W, Hellwig E, Meyer-Lückel H. Radiation-related damage to dentition. *The lancet oncology*. 2006;7(4):326-35.
- Kinane DF, Mark Bartold P. Clinical relevance of the host responses of periodontitis. *Periodontology 2000*. 2007;43(1).

- Konjhodzic-Prsic A, Keros J, Ajanovic M, Smajkic N, Hasic-Brankovic L. Incidence of radiation caries in patients undergoing radiation therapy in the head and neck region. *Pesquisa Brasileira em Odontopediatria e Clinica Integrada*. 2010;10(3):489-92.
- Loe H. Silness: Periodontal disease in pregnancy. *Acta Odontol Scand*. 1963;22:533.
- Naidu MUR, Ramana GV, Rani PU, Suman A, Roy P. Chemotherapy-induced and/or radiation therapy-induced oral mucositis-complicating the treatment of cancer. *Neoplasia*. 2004;6(5):423-31.
- Pajari U, Ollila P, Lanning M. Incidence of dental caries in children with acute lymphoblastic leukemia is related to the therapy used. *ASDC journal of dentistry for children*. 1995;62(5):349-52.
- Ramfjord SP. Indices for prevalence and incidence of periodontal disease. 1959.
- Sabah Saka BDS, Mays Rafid BDS. Assessment of salivary flow rate and secretory immunoglobulin A and oral mucosal changes in acute myeloid leukemia before and after the induction phase of chemotherapy. *Scientific Journal Published by the College of Dentistry–University of Baghdad*.82.
- Sciubba JJ, Goldenberg D. Oral complications of radiotherapy. *The lancet oncology*. 2006;7(2):175-83.
- Silness J, Loe H. Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition. *Acta odontologica scandinavica*. 1964;22(1):121-35.
- Soutome S, Funahara M, Hayashida S, Nakamura K, Umeda M. Risk factors for radiation-induced dental caries in patients with head and neck cancer. *Oral Health Care*. 2017;2:1-4.
- Springer IN, Niehoff P, Warnke PH, Böcek G, Kovács G, Suhr M, et al. Radiation caries—radiogenic destruction of dental collagen. *Oral oncology*. 2005;41(7):723-8.
- Vissink A, Jansma J, Spijkervet FKL, Burlage FR, Coppes RP. Oral sequelae of head and neck radiotherapy. *Critical Reviews in Oral Biology & Medicine*. 2003;14(3):199-212.