

Research Article



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Knowledge And Awareness Of Cancer Immunotherapy Among Dental Students And Dental Professionals- A Questionnaire Based Survey

Dr Stephy Carolin¹, Dr EAnuradha Sunil², Dr Archana Mukunda^{3*}, Dr Meera K Pynadath⁴, Dr Neethu Kadar⁵, Dr Divya R⁶

¹PG student, Department of Oral and Maxillofacial Pathology, Royal Dental College, Chalissery 679536 Palakkad, India

²HOD, Department of Oral and Maxillofacial Pathology, Royal Dental College, Chalissery 679536, Palakkad, India

^{3*,4}Professor, Department of Oral and Maxillofacial Pathology, Royal Dental College, Chalissery 679536, Palakkad, India

^{5,6}Reader, Department of Oral and Maxillofacial Pathology, Royal Dental College, Chalissery 679536, Palakkad, India

Corresponding author: Email: kavin27@gmail.com

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ABSTRACT

Background: Cancer immunotherapy has emerged as a revolutionary approach in cancer treatment, significantly improving patient outcomes. As oral healthcare providers

often play a role in early cancer detection and multidisciplinary care, it is crucial for dental students and professionals to possess adequate knowledge and awareness of this therapeutic modality.

Aim: To assess the knowledge, attitude, and practice (KAP) related to cancer immunotherapy among undergraduate and postgraduate dental professional.

Methods: A cross-sectional, questionnaire-based online survey was conducted among dental undergraduates, postgraduates, and practicing professionals. The questionnaire included items on

general knowledge, clinical relevance, sources of information, and perceived need for education regarding cancer immunotherapy. The responses were scored numerically and represented as percentile and statistically analysed using Pearson Chi-Square test and a p value of ≤ 0.05 was inferred as statistically significant.

Results: Out of 132 respondents, a substantial proportion demonstrated limited knowledge of cancer immunotherapy, especially among undergraduate students. The comparison of age and qualification of the study participants was statistically significant with a p value of ≤ 0.05 , whereas gender was found to be not significant. 98.5% were aware of types of oral cancer and 80.3% had come across patient with oral cancer. 81.8% were aware of targeted drug therapy for cancer, 82.6% were aware that immunotherapy works by boosting immune system and 80.3% were aware that T cells were used in immunotherapy so 81.8% agreed that immunotherapy was an innovative cancer treatment option.

Conclusion: The study highlights a significant knowledge gap regarding cancer immunotherapy among dental students, particularly at the undergraduate level. Integration of immunotherapy-related content into dental curricula and continuing education programs is strongly recommended to equip future dental professionals with essential interdisciplinary competencies in cancer care.

Keywords: Awareness, Cancer immunotherapy, Dental education, Dental professionals, Dental students, Knowledge, Questionnaire survey.

INTRODUCTION

Cancer till date remains an enigma as there is surge of numerous new cases, increase in incidence worldwide and its association with a high rate of mortality.¹ The host immune system put a barrier against these cancer cells but the tumor cell manage to evade the attack of immune system as the cancer cells escape immune recognition causing significant irreparable damage.² The currently available tradition treatment modalities like surgery, chemotherapy, radiotherapy are unsuccessful in curing cancers.³ Immunotherapy is a type of new cancer treatment where there is passive reactivation of immune cells to identify, attack, and eradicate cancer cells.^{4,5} T lymphocytes ensues T cell mediated immune response against tumor cells finally killing them.⁶

William B Coley a bone sarcoma surgeon is considered the father of immunotherapy. In 1891 he injected streptococcal organism into inoperable cancer and observed that there was shrinkage in malignant tumor. In the next 40yrs he and his colleagues injected bacteria or bacterial toxins in more than 900 unresectable sarcomas and found excellent results of $>10\%$ cure rate.⁷ Paul Ehrlich 1909 1st demonstrated that antibodies may have the ability to directly combat cancer cells.⁸

Currently there are 5 types of cancer immunotherapy available all of which are administered intravenously. Check point inhibitors prevent tumors from turning off cancer fighting cells and is used a wide variety of malignancies like melanoma, Hodgkin's lymphoma, head & neck cancers, Merkel cell

carcinoma lung, rectal, kidney cervical, liver, stomach etc. Cell therapy modifies the body's own immune cells to become cancer treating cells used in leukemia and lymphomas. Cytokines boost immune system and is used in advanced melanomas and renal cancers. Treatment vaccines teach body's immune cells to find cancer cells and are used in prostate cancer. Oncolytic virus uses viruses to fight cancer cells and is used in treatment of advanced melanoma.⁹

Cancer immunotherapy is complex and rapidly evolving and dental professional are an integral part of health care system. They encounter oral cancers and metastatic lesions from malignancies elsewhere in the body. Therefore, it is utmost important for dentists to understand about immunotherapy and how it differs from other treatment modalities. The major challenge for success of immunotherapy lies in the information being conveyed to health care professionals including dentists who should in turn pass it on to their patients. Thus, the aim of the present article is to assess the current knowledge, awareness, attitudes, and perceptions of cancer immunotherapy among dental students and dental professionals.

MATERIAL AND METHODS

The current study was a cross-sectional, descriptive, questionnaire-based study conducted online to assess knowledge and awareness of cancer immunotherapy among 132 dental professionals. The current study was done in accordance to ethical standards after obtaining ethical clearance from the Institutional Ethical Committee no RDC/IEC/2024/3916A. The participants willing participated and anonymity was maintained throughout the study. No personal information was collected and the data was stored securely and used solely for research purposes. This survey was conducted using online Google Forms and distributed to dental professional in the month of February and March 2024. Registered dental professional, postgraduates, private practitioners, academic staff who consented to participate and who can read English were included in the current study whereas undergraduate students and interns and those not willing to participate were excluded from the present study. The google forms comprised of participant details like age, gender and qualification along with 16 close ended questions containing multiple choices. The link to the questionnaire were distributed electronically through email, WhatsApp and other social media platforms to ensure wide participation across different Dental Institutions and private practices. The source for the questions was from textbooks, journals, CDE, conferences and social media and the draft questionnaire was reviewed by subject experts (oral medicine, oncology, and public health dentistry) for face and content validity. The survey required around 10-15 minutes to complete and final submission was allowed only after providing consent and duplicate responses were prevented by restricting one submission per google account. All responses were automatically recorded in a secure Google Sheet and later exported to Microsoft Excel for data analysis. The responses were numerically scored where a score of 1 was given to responses correct/yes/agree/positive whereas a score of 0 was given for responses incorrect/don't know/neutral. The responses scored numerically were entered, stored in excel sheet and submitted for statistical analysis using SPSS package 20. The responses obtained were expressed as cumulative percentage. Chi square test was used to determine the

difference between independent variables (age, gender & qualification) and dependent variables (knowledge and awareness of immunotherapy). A p value of <0.05 was considered as statistically significant.

RESULTS

The present study was conducted to assess the knowledge and awareness of dental professional about immunotherapy. The study was an observational cross section study conducted from February to March 2024. The study was conducted using an online survey on 132 dental professionals with a questionnaire comprised of 16 questions; of which 6 questions were to assess their knowledge and 10 questions to assess their awareness about immunotherapy. It was noted that 68 (51.5%) dental professionals were 20-30yrs old and 07 (5.3%) dental professional were above 50yrs of age. The p value noted was 0.002 (highly significant). There were 90 (68.2%) female and 42 (31.8%) male dental professionals in the present study and the M:F was 2:1. The p value observed was 0.986 (not significant). In the present study 49 (37.1%) were graduates, followed by 41 (31.1%) PG students, 33 faculty and 9 (6.8%) were GDPs. The p value was 0.003 (highly significant). [Table 1 & Table 2].

Out of 132 dental professionals 98.5% (130) were aware of the types of oral cancers and 80.3% (106) had come across a patient with Oral Squamous Cell Carcinoma. For the currently available treatment options for cancer, 71.2% (94) responses opted chemotherapy followed by 18.2% (24) responses opting surgery, 5.3% (07) responses opting surgery and immunotherapy. (Chart 1)

81.8% (108) participants had heard about targeted drug therapy for cancer and 82.6% (109) participants were aware that cancer immunotherapy works by boosting immune system to recognize and attack cancer cells. 80.3% (106) were aware that T cell was the most active cell in fighting cancer, 81.8% (107) agreed that immunotherapy is an innovative treatment option and 70.5% (93) participants knew that cancer immunotherapy is prescribed by a medical oncologist. 85.6% (113) participants felt that the key benefits of immunotherapy are safety (fewer side effects), 63.6% (84) efficacy and 55.3% (73) patient acceptance. (Chart 2)

75% (99) of them agree that immunotherapy increases survival when combined with traditional treatment and 31% (41) knew that immunotherapy is administered in out-patient clinical setting. 54.5% (72) knew that immunotherapy is given as injections whereas 22.7% (30) believed immunotherapy is given as oral pills and as topical. 40.9% (54) knew that leukemia and lymphomas are best treated with immunotherapy. 90.2% (119) agree that awareness about immunotherapy is relevant to their profession or training. To increase their knowledge on immunotherapy, data from long clinical trials was opted by 41.7% (55), 35.6% (47) opted for education provided by specialists, 18.9% (25) opted for data from published studies, 3.8% (5) opted for patient testimonials. (Chart 3) 87.9% (116) expressed their positive attitude towards immunotherapy for treating cancers. (Table 4)

DISCUSSION

In contemporary society, cancer stands out as a prevalent disease with an alarmingly high death rate, creating substantial problems and hurdles in its management. The area of cancer treatment is still grappling with difficulties, as the existing therapies tend to lack effectiveness. The newly emerging strategy of immunotherapy is delivering significant benefits in the battle against cancer. Approaches to immunotherapy include stimulating effector mechanisms while countering inhibitory and suppressive factors.¹⁰

At present, there are five types of cancer immunotherapy available, all of which are delivered intravenously. Checkpoint inhibitors stop tumors from deactivating cancer-fighting cells and are utilized for a wide range of malignancies, including melanoma, Hodgkin's lymphoma, head and neck cancers, Merkel cell carcinoma, as well as lung, rectal, kidney, cervical, liver, and stomach cancers, among others. Cell therapy alters the body's immune cells to transform them into cancer-fighting cells, primarily used for leukemia and lymphomas. Cytokines enhance the immune system and are applied in advanced melanomas and renal cancers. Treatment vaccines instruct the body's immune cells to identify cancer cells and are employed in prostate cancer. Oncolytic viruses utilize viruses to combat cancer cells and are used in the treatment of advanced melanoma.¹¹

The present study was an online questionnaire-based awareness study conducted on randomly selected 132 dental professionals. All most all the participants were aware about the types of oral cancers which would play a critical role in early detection, prevention and educating patients and was similar to the study of NS Prado et al 2020.¹²

Most of the participant had come across a patient with squamous cell carcinoma and they also identified immunotherapy as the current available treatment for cancer along with targeted drug therapy for cancer. Majority of participants agreed that immunotherapy as an innovative treatment option for cancer and is prescribed by a medical oncologist. Maximum participants knew that immunotherapy works by boosting immune system to recognize and attack cancer cells.¹³

Dental professionals were aware that fewer side effects are the key benefits of immunotherapy.¹⁴

Three fourth of dental professional were further aware that immunotherapy when combined with traditional treatment increases the rate of survival. Traditional cancer treatment results in hypoxic cells which are resistant to therapy. Combining immunotherapy with traditional therapy improves the response in controlling cancer cells.¹⁵ However, majority of the participants were not aware that immunotherapy was administered in the outpatient setting and as intravenous injections and thus needs to be updated. Localized injection strategies given at tumor site minimizes the systemic side effects.¹⁶ Participants were not aware that immunotherapy has high rate of success when used for lymphomas and leukaemia. It is shown that effective curative rate with lymphomas is 80%.¹⁷

Almost all participants expressed that training about immunotherapy is relevant in all speciality which is highly accurate. Awareness about immunotherapy is highly needed in every medical speciality field

due its expanding use and wide range applications and complex side effects which directly correlates with safety, effective management long with adverse effects which affect multiple organ system.¹⁸

The participants of the study expressed to update their knowledge on immunotherapy through results of long-time clinical trials followed by education provided by specialists, publishing more case studies and patient testimonials. Though we did not come across any study with relating findings on immunotherapy, dental professional prefers to update their knowledge on oral cancer and its updates majorly through media, followed by their peer and internet.¹²

LIMITATIONS

This study has several limitations that should be acknowledged. Firstly, the sample size was limited and may not be representative of the broader population of dental professionals, which restricts the generalizability of the findings. Additionally, selection bias may have occurred, as participants with a prior interest in immunotherapy may have been more likely to participate, potentially overestimating the actual level of awareness. The study relied on self-reported data, which is susceptible to response and social desirability biases, particularly in the attitude and practice sections. The questionnaire used, while carefully constructed, was not validated through a pilot study or statistical reliability testing, which may affect the accuracy of the measurements. Furthermore, given the rapidly evolving nature of immunotherapy, some information may have become outdated by the time of analysis.

CONCLUSION

The knowledge, attitudes, and practices of dental professionals regarding immunotherapy are crucial for ensuring that patients receive comprehensive and informed care. While many dental practitioners possess a foundational understanding of immunotherapy, there is a notable gap in specific knowledge related to its implications in dental practice. Enhancing dental professionals' awareness of immunotherapy, its side effects, and potential interactions with dental treatments can improve patient outcomes and ensure safe, effective care. Continuous professional education, workshops, and collaborations with oncology and immunology experts will play a pivotal role in bridging these knowledge gaps. With increasing advancements in immunotherapy, it is essential for dental professionals to stay updated and equipped to integrate these innovations into patient care, fostering interdisciplinary communication and improving overall treatment success.

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LIST OF TABLES

Table 1 showing Frequency distribution of age, gender and qualification in the present study

Frequency	Counts	Percentage in total	Cumulative Percentage
Age			
20-30yrs	68	51.5%	51.5%
30-40yrs	40	30.3%	81.8%
40-50yrs	17	12.9%	94.7%
>50yrs	07	5.3%	100%
Gender			
Females	90	68.2%	68.2%
Males	42	31.8%	100%
Qualification			
Faculty	33	25%	25%
PG students	41	31.1%	56.1%
Practitioners	9	6.8%	62.9%
Graduates	49	37.1%	100%

Table 2 showing p value of Chi square test for age, gender and qualification

	Value	df	P value
Age			
χ^2	20.8	06	0.002**
N	132		
Gender			
χ^2	0.0291	02	0.986*
N	132		
Qualification			
χ^2	20.0	6	0.003**
N	132		
* Not statistically significant			
** Highly Statistically significant			

Table 3 showing descriptive data of the present study

Descriptive	Total Score
N	132
Missing	100
Mean	18.3
Median	19.0
Standard Deviation	3.45
IQR	5.0
Minimum	09
Maximum	26

Table 4 showing frequency distribution, total percentage, and cumulative percentage of all the responses

FREQUENCY	Cou nts	Total %	Cumulativ e %
1. Are you aware of the types of oral cancers			
• No	02	1.5%	1.5%
• Yes	130	98.5%	100.0%
2. Have you come across a patient with squamous cell carcinoma			
• No	26	19.7%	19.7%
• Yes	106	80.3%	100.0%
3. Currently available treatment options for cancer (multiple selection allowed)			
• Surgery	7	5.3%	5.3%
• Chemotherapy	7	5.3%	10.6%
• Radiotherapy	24	18.2%	28.8%
• Immunotherapy	94	71.2%	100.
4. Have you heard about targeted drug therapy for cancer	7		
• No	24	18.2%	18.2%
• Yes	108	81.8%	100.0%
5. How does cancer Immunotherapy work			
• Others	23	17.4%	17.4%
• Boosts immune system to recognize and attack cancer cells	109	82.6%	100.0%
6. Which immune cell is most active in fighting cancer			
• Others	26	19.7%	19.7%
• T Cells	106	80.3%	100.0%

7. Do you agree that immunotherapy is an innovative Treatment option for Cancer			
<ul style="list-style-type: none"> ● Disagree ● Agree 	25	18.9%	18.9%
	107	81.8%	100.0%
8. Cancer immunotherapy is prescribed by			
<ul style="list-style-type: none"> ● Other ● Medical Oncologist 	39	29.5%	29.5%
	93	70.5%	100.0%
9. What according to you are key benefits of Immunotherapy?			
<ul style="list-style-type: none"> ● Efficacy ● Patient acceptance ● Safety (fewer side effects) 	52	39.4%	39.4%
	20	15.2%	54.6%
	60	45.5%	100.0%
10. Do you agree that immunotherapy when combined with traditional treatment increases survival			
<ul style="list-style-type: none"> ● Disagree ● Agree 	33	25.0%	25.0%
	99	75.0%	100.0%
11. In which clinical setting is Immunotherapy administered			
<ul style="list-style-type: none"> ● Others ● Out-patient setting 	91	69.0%	69.0%
	41	31.0%	100.0%
12. In what form is immunotherapy administered			
<ul style="list-style-type: none"> ● Injections ● Oral pills ● Topical 	72	54.5%	54.5%
	30	22.7%	77.3%
	30	22.7%	100.0%

13. Which malignancy is best treated with immunotherapy			
<ul style="list-style-type: none"> • Others 	78	59.1%	59.1%
<ul style="list-style-type: none"> • Leukemia & Lymphoma 	54	40.9%	100.0%
14. Do you think awareness about immunotherapy is relevant to your specialty training			
<ul style="list-style-type: none"> • No 	13	10.6%	10.6%
<ul style="list-style-type: none"> • Yes 	119	90.2%	100.0%
15. What type of data would be useful to increase knowledge or belief of immunotherapy in cancer			
<ul style="list-style-type: none"> • Long term clinical trials 	55	41.7%	41.7%
<ul style="list-style-type: none"> • Education provided by specialists 	47	35.6%	77.3%
<ul style="list-style-type: none"> • Patient testimonials 	5	3.8%	81.1%
<ul style="list-style-type: none"> • Publishing more case studies 	25	18.9%	100.0%
16. Indicate your attitude towards Immunotherapy for cancers			
<ul style="list-style-type: none"> • Negative 	16	12.1%	21.1%
<ul style="list-style-type: none"> • Positive 	116	87.9%	100.0%

LIST OF CHARTS

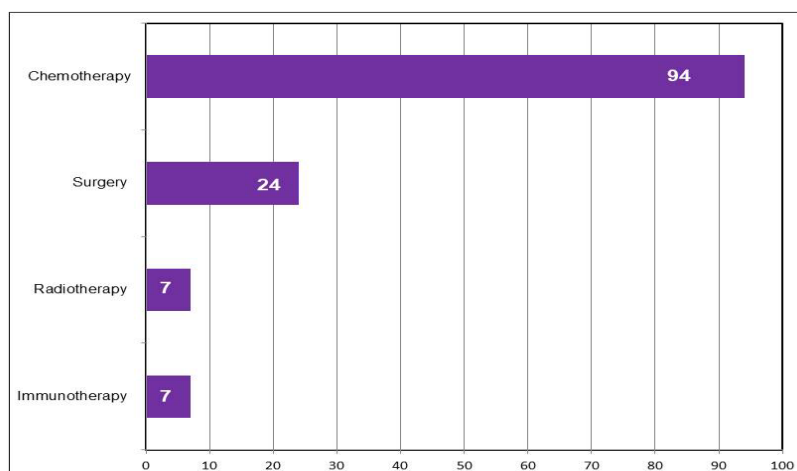


Chart 1 Bar graph showing responses currently available treatment option for cancer

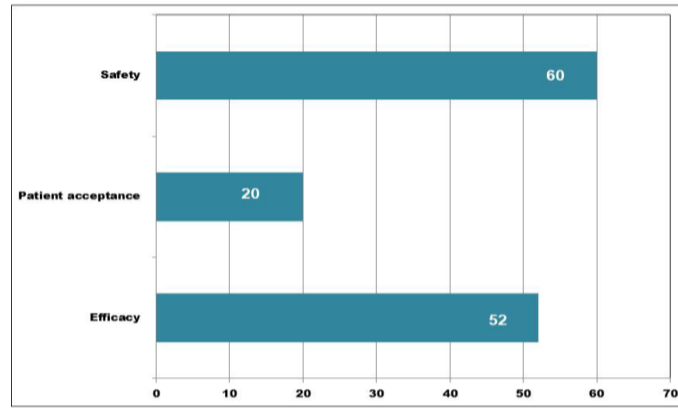


Chart 2 Bar graph showing responses to Key benefits of immunotherapy

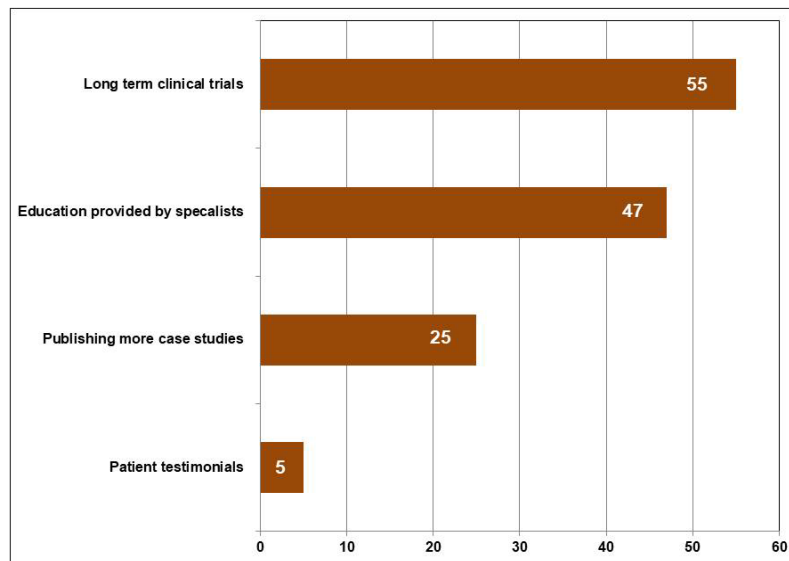


Chart 3 Bar graph showing responses to option to increase knowledge of immunotherapy in treating cancer