
Knowledge and Awareness Among Dental Students Regarding Carcinoma of Maxillary Sinus

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Abstract: Maxillary sinus malignancies are rare worldwide. The disease usually presents at an advanced stage making its management challenging for all the medical personnel involved in its treatment. Because of its location deep within the maxilla and its proximity to critical surrounding structures, radiotherapy plays an integral role in sterilizing the area of malignant cells. Sinonasal malignancies occur twice as often in males as in females, and are most often diagnosed in patients 50 to 70 years of age. Maxillary sinus carcinomas are aggressive in nature which present with symptoms in the advanced stages when radical resection becomes the only choice. It is essential to study the basis of such carcinomas and create awareness among patients and dental students to ensure early diagnosis and therefore a good prognosis. A questionnaire based study was conducted among dental students of third, fourth year and interns at a private dental college in Chennai, Tamilnadu, India to assess their knowledge and understanding of carcinomas of maxillary sinus. A multiple choice questionnaire was presented to 103 subjects and their responses were noted, tabulated and statistical analysis was performed using SPSS by IBM by performing Chi-square test. Among 103 subjects, 28 were third year students (27.2%), 47 were interns (45.6%) and remaining 28 of the subjects were fourth year students. Fourth year students had increased awareness about carcinomas of maxillary sinus when compared to third year students and interns in most cases ($p > 0.05$).

Keywords: carcinoma; maxillary sinus; antrum; paranasal sinus; malignancy; survey; dental students

INTRODUCTION

The maxillary sinus also known as the antrum of Highmore, is one of the largest paranasal sinuses. It drains into the middle meatus of the nose through the osteomeatal complex. (Standring, 2015) It was initially identified by the ancient Egyptians, and sufficient research has been done regarding its structure, vascular anatomy, and relationship with the teeth. (Mavrodi and Paraskevas, 2013) The maxillary sinus begins to develop by the 10th week of gestation by formation of invaginations and rapid growth of the MS has been observed during two periods of development from the 17th to the 20th week and from the 25th to the 28th week. Ossification of the sinus begins during the 16th week of development and the medial wall shows signs of ossification by the 37th week of gestation. (Nuñez-Castruita, López-Serna and Guzmán-López, 2012) These completely bone-encased, pneumatic cavities are lined by epithelium, which includes mucin-secreting glandular components, and rests in apposition to the periosteum. The orbit, palate, alveolar ridge, pterygoid fossa, ethmoid and sphenoid sinuses, nasal fossa, and soft tissues of the cheek are contiguous with the bony walls. (Cantril, Parker and Lund, 1962)

Cancers of the nasal cavity and paranasal sinuses are rare, comprising less than 1 percent of all human malignancies and only 3 percent of those arising in the head and neck. (Silverberg and Grant, 1970) Sinonasal malignancies occur twice as often in males as in females, and are most often diagnosed in patients 50 to 70 years of age. (Carrau, Myers and Johnson, 1992) The majority of these tumors are squamous cell carcinoma, although a wide variety of other malignancies including sarcoma, adenoid cystic carcinoma, lymphoma, melanoma, and olfactory neuroblastoma may occur at this site. (Roberts *et al.*, 1990)

Primary malignant tumors of the maxillary sinus are relatively rare. Their occurrence is estimated to be only one or two for every 1,000 cancers at other sites. The majority (roughly 90 per cent) of these tumors are

histologically epidermoid carcinomas and anaplastic tumors, adenocarcinomas and sarcomas are occasionally encountered. (Kurohara *et al.*, 1972) The prognosis of most of the patients presenting with carcinomas of maxillary sinus end up being poor. The complex anatomic structure of the maxillary sinus is a major contributor to the difficulty of evaluation and management of these tumors. Anatomical assessment correlated with pathologic tumor type, duration of history, and general condition of the patient has proved to be an integral part of the therapeutic and prognostic evaluation.

The gross pathologic characteristics of all malignant neoplasms of the maxillary sinuses manifest a strikingly uniform pattern which is predetermined largely by the anatomic composition and location of these structures. These uniform gross characteristics include tumor growth into the lumina of the sinuses with resulting obstruction of their orifices and early invasion of the bony encasement with extension into surrounding vital structures. (Cantril, Parker and Lund, 1962) One of the most characteristic neoplastic features of carcinomas of maxillary sinuses is its multifocal origin. The concept of multifocal origins of these epithelial tumors likewise makes it extremely hazardous to predetermine the confines of the tumor in question and the anatomy often precludes any reasonable consideration of surgical exploration of the sphenoid and/or the ethmoid sinuses other than necessary drainage procedures. This further explains the complicated evaluation problem and must be taken into account while considering the therapeutic path taken, be it surgery, radiation or chemotherapy or a combination. (Larsson and Mårtensson, 1954)

The prognosis of maxillary sinus is often poor as they are difficult to treat which is due to its close anatomic proximity to vital structures such as the skull base, brain, orbit, oral cavity and carotid artery. Its complex location makes complete surgical resection of sinonasal tumors a challenging and sometimes impossible task. In addition, tumors of the paranasal sinuses and nasal cavity tend to be asymptomatic at early stages, appearing more frequently at late stages once extensive local invasion has occurred. The presenting symptoms of carcinomas of maxillary sinus vary depending on the anatomical extent rather than the tumour type. The most reported symptom has been unilateral facial pain followed by toothache unrelieved by extraction, nasal obstruction, epistaxis or discharge, swelling of the cheek, visual disturbances, alteration of the palate or alveolar ridge, failure of healing of extraction site, trismus, facial numbness and loss of auditory acuity. All these signs point to an advanced stage of malignancy of maxillary sinus. (Larsson and Mårtensson, 1954)

Treatment modalities for malignancy of the maxillary sinus can be surgical resection, radiotherapy and chemotherapy. They are used in combination with each other and as a single modality depending on the extent of the malignancy, to obtain better local control and maintain function. However, employing surgery and radiotherapy has been the gold standard in the treatment of resectable sinonasal carcinomas. The overall 5 year survival rate too varied among various studies done in the field depending on the treatment modality used. Surgery can be divided into partial and total maxillectomy, radiotherapy into radical and palliative and chemotherapy can be classified as neoadjuvant, concurrent and adjuvant. (Lasebikan *et al.*, 2017)

Due to its rapid progress and anatomic position, it is of major importance to maxillofacial surgeons to come up with an efficient treatment or surgical modality. Previously our department has published extensive research on prosthetic dentistry (Venugopalan *et al.*, 2014; Ashok and Suvitha, 2016; Ganapathy *et al.*, 2016; Ajay *et al.*, 2017; Jyothi *et al.*, 2017; Kannan and Others, 2017; Ranganathan, Ganapathy and Jain, 2017; Jain *et al.*, 2018; Duraisamy *et al.*, 2019), on effect of various drugs (Selvan and Ganapathy, 2016; Subasree, Murthykumar and Others, 2016), oral hygiene status of women (Basha, Ganapathy and Venugopalan, 2018), on the effect of impregnated gingival retraction cords (Kannan and Venugopalan, 2018), on the medical management of cellulitis (Vijayalakshmi and Ganapathy, 2016), this vast research experience has inspired us to research this topic. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020) This study aims to assess the knowledge and awareness of carcinomas of maxillary sinus among dental students studying at a private dental hospital in Tamilnadu, India.

MATERIALS AND METHODS

Background:

The questionnaire based study was conducted among the students studying at a private dental college to assess their knowledge on malignancies of the maxillary sinus. It was conducted in the city of Chennai, Tamilnadu, India during January 2020.

Study design:

A questionnaire was created on Google Forms and The subjects were administered with a structured questionnaire encompassing their knowledge and awareness of carcinomas of maxillary sinus. The Multiple-Choice Questionnaire developed, had 11 questions and it was made sure that individuals gave their first natural response and attempted all the questions spontaneously. Anonymity was maintained and their responses were noted and tabulated. Ethical approval to conduct the study was obtained from the ethical review board of Saveetha Institute of Medical and Technical Sciences.

Inclusion criteria:

3rd, 4th students and interns studying at a private dental college were included in the study

Exclusion criteria:

Post graduate students, professors were excluded from the study. Incomplete responses were excluded due to the risk of bias.

Statistical analysis:

The responses were tabulated and Chi square tests were performed using SPSS software by IBM

Limitations of study:

The study was conducted only in one private dental hospital and thus confined to one metropolitan area.

RESULTS & DISCUSSION

A total of 103 patients participated in this questionnaire based study among which 28 were third year students (27.2%), 47 were interns (45.6%) and remaining 28 of the subjects were fourth year students (Table 1). Regarding the predominant gender affected by carcinomas of maxillary sinus (Males), the majority of all the students got it right, however, $p > 0.05$. Third years - 15.53%, Fourth years - 16.5% and interns - 25.24% (Graph 1). When asked about the type of carcinoma (Graph 2) most commonly affecting the maxillary sinus (squamous cell carcinoma), the majority of students of 3rd year (11.65%) and 4th year (19.42%) answered correctly whereas a 16.50% of interns answered adenoid cystic carcinoma as the most common carcinoma affecting maxillary sinus ($p > 0.05$). Question regarding the prognosis (Graph 3) of carcinomas of maxillary sinus (Poor prognosis), greater percentage of 3rd (18.45%) and 4th year (20.39%) students chose the right answer ($p < 0.05$) whereas there was not much difference among interns choosing the two options.

Regarding the age group (50 to 70 years) most predominantly found, the majority of the students did not get it right and there was a significant difference among all three students groups (Graph 4). Only 8% of third year students, 6.8% of fourth year students and 10.6% of interns got it right. ($p < 0.05$). Majority of the students when asked about the recurrence rate of maxillary sinus carcinomas answered correctly stating that it has a high rate of recurrence ($p < 0.05$, Graph 5). 17% of 4th year students answered incorrectly when asked about the percentage of maxillary sinus carcinomas among all head and neck cancers (3%) as 82%. More number of interns got the answer right regarding it when compared to 3rd years ($p < 0.05$ - Graph 6). The gold standard of treatment preferred (Surgery + radiotherapy) was answered right by a greater number of fourth year students followed by interns ($p > 0.05$ - Graph 7). Majority of interns answered the question of incidence of lymph node metastasis (20%) when compared to third year and final year students ($p > 0.05$).

The prognosis for maxillary sinus malignancies has remained poor for the past several decades despite improvements in both surgical technique and radiation therapy. There was not much significant improvement currently when compared to studies done on maxillary sinus carcinomas 20 years back (Stern *et al.*, 1993). Surgery with postoperative radiation therapy remains the standard treatment for resectable sinonasal carcinomas. Treating maxillary sinus cancer is challenging because of the proximity of critical structures, such as the eye and the brain, which preclude wide surgical excision and high-dose radiotherapy. The clinical course is indolent at most and a substantial number of patients have advanced disease at the time of diagnosis (Popović and Milisavljević, 2004). Local control is a particularly difficult problem, with the majority of failures occurring at the primary site. These difficulties with maxillary cancer treatment are linked to the complex anatomy of the paranasal sinus region, and a propensity for late presentation due to the absence of symptoms in an early stage of disease. Improved reconstructive techniques including microvascular free flaps and prosthetic obturators have significantly decreased the functional and cosmetic morbidity from aggressive surgical resection.

The annual incidence of maxillary sinus cancer is 0.5–1.0 case per 100,000 of the population worldwide (Chan, no date). However, due to its aggressive nature, it is imperative that now more than ever, oral and maxillofacial surgeons, oral medicine and oral pathologists come together to ensure the early detection and efficient treatment of carcinomas of maxillary sinus. The questionnaire based study on carcinomas of maxillary sinus was conducted among third year, fourth year students and interns.

A male predominance is observed in the incidence of maxillary sinus carcinomas with a male:female ratio of 1.4:1 (Lasebikan *et al.*, 2017) however, there was not a significant difference between the different student groups ($p > 0.05$) but a trend was observed in the direction that most of the students were aware of this gender predominance. Squamous cell carcinoma is the most common type of the malignancy affecting the maxillary sinus as reported by several studies (Giri *et al.*, 1990; Popović and Milisavljević, 2004; Wang *et al.*, 2020).

Regarding this, the third year and final year students were well aware of this when compared to the interns, the majority of whom got it wrong. A similar pattern was noted when questioned about the prognosis of maxillary sinus carcinomas. This can be explained by the subjects of oral pathology and oral medicine being taken up by the 3rd and 4th year students respectively. There is a need for seminars or workshops to continually update knowledge among interns and dental practitioners regarding carcinomas of maxillary sinus.

A significant insufficiency of knowledge regarding the age group most commonly affected by maxillary sinus carcinomas was noted among all the student groups ($p<0.05$). However all student groups had sufficient knowledge regarding the high recurrence rate of maxillary sinus carcinomas ($p<0.05$), this can be explained by their sound anatomical understanding of the maxillary sinus. The preferred treatment modality as surgery and radiotherapy in combination was answered right by a greater percentage of fourth year students and interns. This can be explained by the subject of oral medicine being taught in the fourth year of dental studies which provides more insight into the management of oral diseases.

Based on the results, it can be deduced that the dental students have less than expected knowledge regarding carcinomas of maxillary sinus and there is a need to appropriate the same. Maxillary sinus carcinomas are aggressive in nature which present with symptoms in the advanced stages when radical resection becomes the only choice. It is essential to study the basis of such carcinomas and create awareness among patients and dental students to ensure early diagnosis and therefore a good prognosis. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

CONCLUSION

In our study, it can be concluded that within the limits of the study, the fourth year students had better knowledge regarding carcinomas of maxillary sinus than interns and third year students. Seminars, workshops and conferences on the same are the need of the hour to initiate further studies and thus educate dentists and public health programs to create awareness among the general population.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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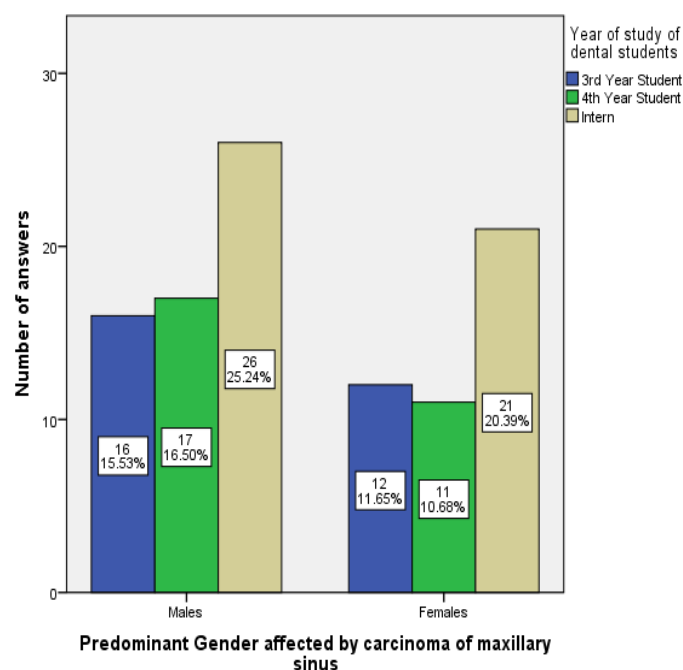
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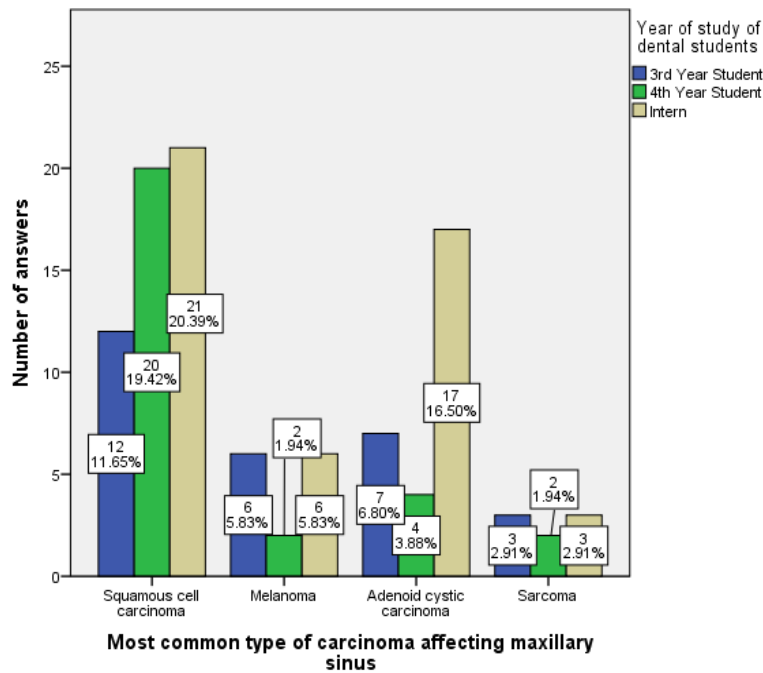
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Table 1: Frequency and percentage of the number of students in each group

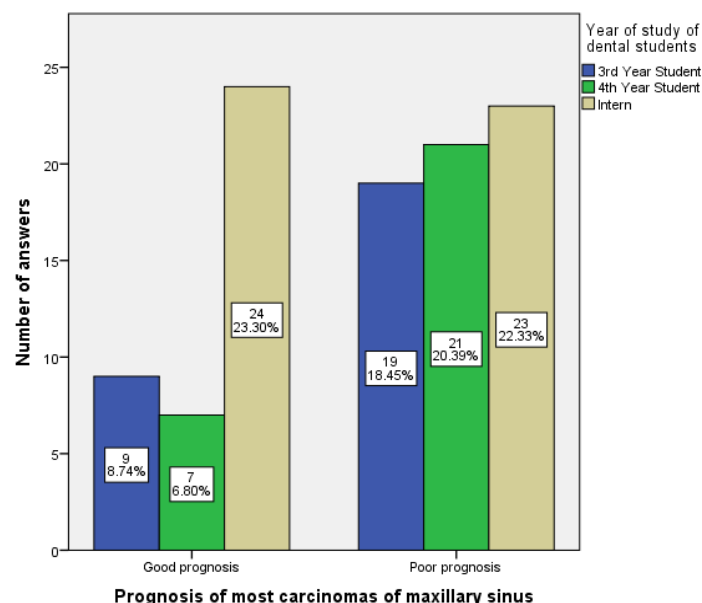
Year of study	Frequency	Percentage
3rd year students	28	27.2%
4th year students	28	27.2%
Interns	47	45.6%



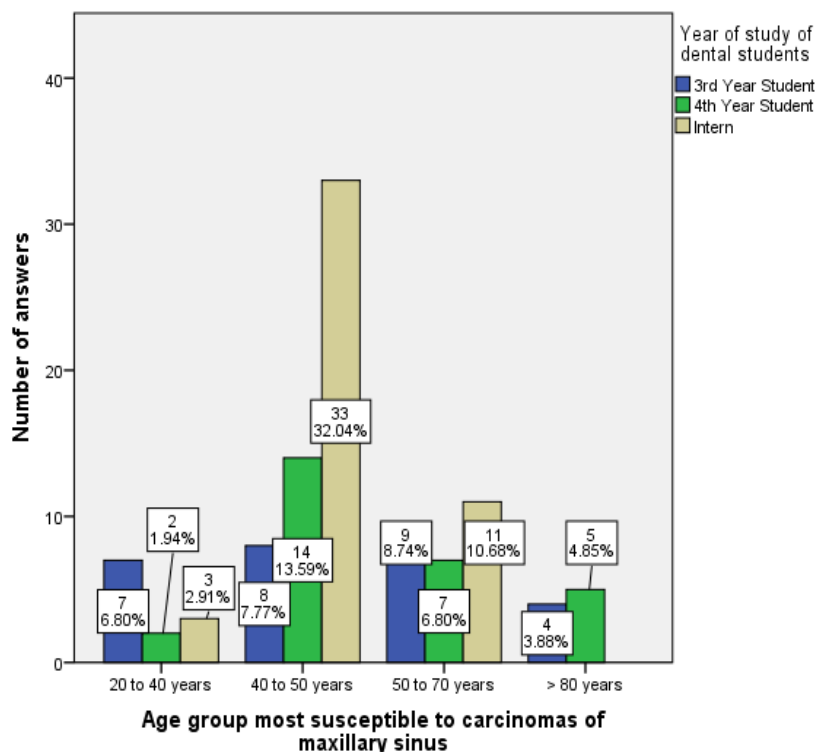
Graph 1: Bar graph representing association between question of the predominant gender affected by carcinoma of maxillary sinus and year of study of the dental student. X axis represents the gender and Y axis represents the number of answers in each category. Chi square test, p value: 0.901: non significant however there was a trend observed in the direction that the majority of all the subjects gave the right answer regarding the predominant gender (males) affected by maxillary sinus carcinoma.



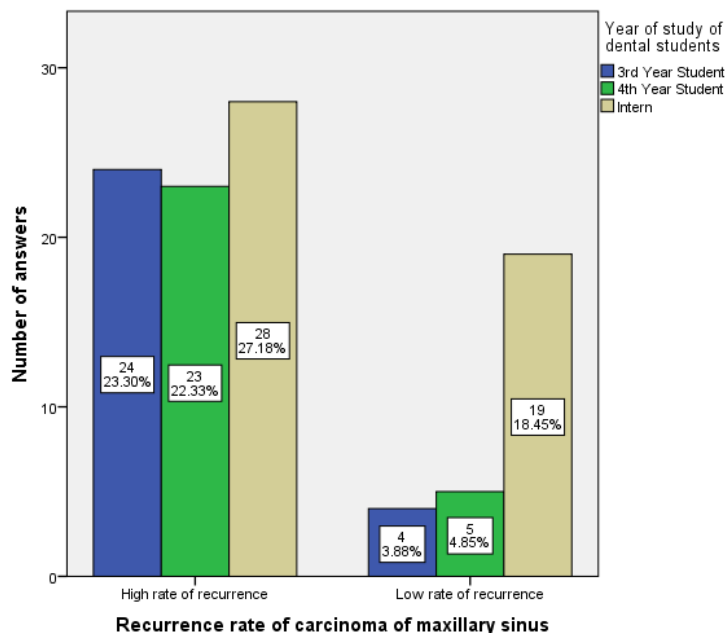
Graph 2: Bar graph representing association between question of the most common type of carcinoma affecting the maxillary sinus and year of study of the dental student. X axis represents the types of carcinoma and Y axis represents the number of answers in each category. Chi square test, p value: 0.189: non significant however there was a trend observed in the direction that the majority of all the subjects gave the right answer regarding the most common type of carcinoma affecting the maxillary sinus (Squamous cell carcinoma). A greater number of fourth year students were observed to have given the right answer.



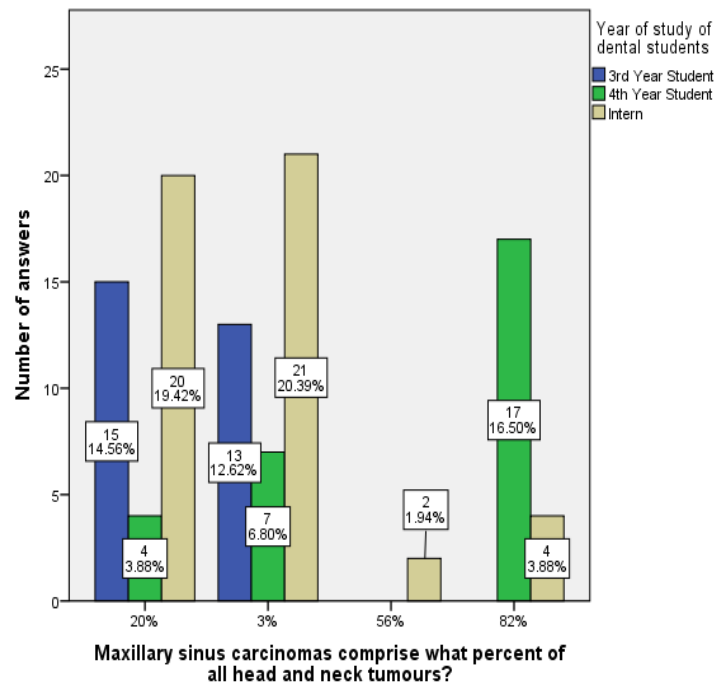
Graph 3: Bar graph representing association between question of the prognosis of carcinomas of maxillary sinus and year of study of the dental student. X axis represents the prognosis and Y axis represents the number of answers in each category. Chi square test, p value: 0.05: significant. Majority of the students among third years and fourth years had significantly sufficient knowledge regarding the prognosis of maxillary sinus carcinomas than the interns.



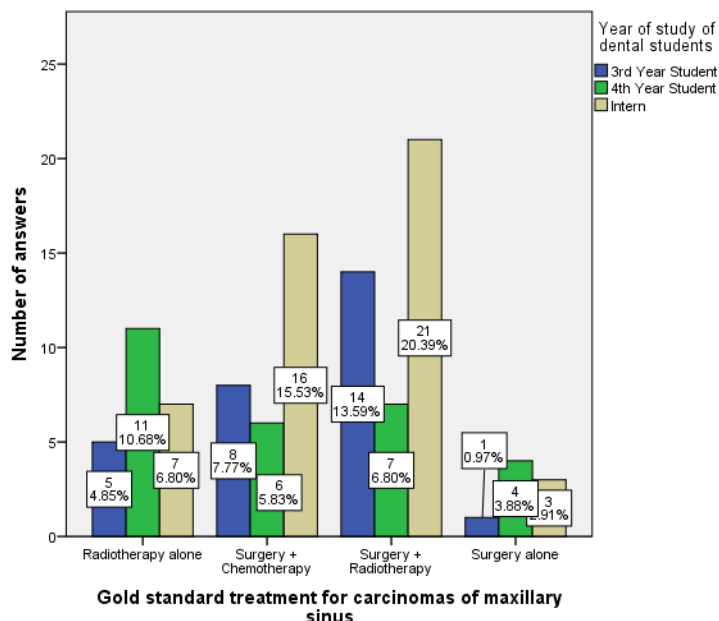
Graph 4: Bar graph representing association between question of the age group most susceptible to carcinomas of maxillary sinus and year of study of the dental student. X axis represents the age groups and Y axis represents the number of answers in each category. Chi square test, p value: 0.003: significant. Majority of the students among all groups significantly had no knowledge on the age groups most susceptible to carcinoma of maxillary sinus.



Graph 5: Bar graph representing association between question of the recurrence rate of carcinomas of maxillary sinus and year of study of the dental student. X axis represents the recurrence rate and Y axis represents the number of answers in each category. Chi square test, p value: 0.021: significant. Majority of the students among third years and fourth years had significantly sufficient knowledge regarding the recurrence rate of maxillary sinus carcinomas than the interns.



Graph 6: Bar graph representing association between question of the percentage of carcinomas of maxillary sinus among head and neck cancers and year of study of the dental student. X axis represents the percentage of maxillary sinus carcinomas and Y axis represents the number of answers in each category. Chi square test, p value: 0.00: significant. Majority of the interns had significantly more knowledge regarding the percentage of carcinomas of maxillary sinus among head and neck cancers.



Graph 7: Bar graph representing association between question of the gold standard treatment of carcinomas of maxillary sinus and year of study of the dental student. X axis represents the treatment modality and Y axis represents the number of answers in each category. Chi square test, p value: 0.097: non significant however a trend was seen in a direction where a greater number of fourth year students followed by interns had sufficient knowledge regarding the preferred treatment modality of maxillary sinus carcinomas.