



Knowledge, Attitude and Practice on Dental Amalgam Restoration among Dental Students

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Authors' contributions

This work was carried out in collaboration between both authors. Author KN performed the analysis, interpretation and wrote the manuscript. Author MR contributed to conception, data design, analysis, interpretation and critically reviewed the manuscript. Both the authors had discussed the results and contributed to the final manuscript.

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ABSTRACT

Amalgam has been used in Dentistry for about 150 to 200 years and is still under use due to its low cost, ease of application, strength and durability. It is an alloy of mercury, is an excellent and versatile restorative material. The development of various tooth coloured cements and resins serves as an alternative and have reduced the use of amalgam. Yet, amalgam stands as one of the excellent restorative materials. The aim of the study was to assess the knowledge, awareness and practice of dental amalgam among dental students in a private dental school. Study was conducted as a cross sectional questionnaire based study among the dental students. The study was conducted as an online survey as it is timesaving and a majority of the population can be covered. There were one hundred participants involved in this online survey from second year, third years, final years and internship. The questionnaire consisting of ten questions were posted for an online survey using google forms. The validity of the questionnaire was cross verified by experts. The data were extracted and tabulated in MS Excel sheets with respect to each question and their response.

The data obtained were subjected to statistical analysis using SPSS software v20. Chi square test was done to assess the association between the variables. The descriptive data obtained were plotted in bar graphs. It was evident that interns had adequate knowledge about amalgam restorations than other participants.

Keywords: Amalgam; disposal; durability; mercury toxicity.

1. INTRODUCTION

Amalgam has been used in Dentistry for about 150 to 200 years and is still under use due to its low cost, ease of application, strength and durability [1]. It is an alloy of mercury. Amalgam consists of an alloy of silver, copper, tin and zinc combined with mercury. Modern amalgams are available in capsule form that consist of 45% of mercury. There are several advantages of pre capsulated amalgams that include convenience in use, reduction or sometimes there is no evidence of amalgam spill during mixing [2].

Research done on the durability of amalgam has shown that the restorations last longer than expected. Older generation amalgam (low copper amalgams) had a comparatively shorter lifespan due to the presence of gamma 2 phase that caused weakening of the restoration by corrosion. Studies have proved that the high copper amalgams have a satisfactory performance. Also, high copper amalgam does not necessarily require polishing after placement whereas it is important in low copper amalgam to increase its longevity. Copper when combined with zinc provides resistance to the restoration from corrosion [3]. However, other factors that cause damage to the restorations like marginal fracture, bulk fracture, tooth fracture are still reported [4].

To overcome the microleakage of amalgam, a coating of resin was used over amalgam restoration. This was not as effective as expected because the resin would wear away after some time however it delayed the microleakage [5]. Fluoridated amalgam was introduced to produce a cariostatic effect and to reduce recurrence of caries around the amalgam restoration studies have confirmed that fluoride containing amalgam released fluoride for several weeks thus acting as a slow release device [6]. Bonded amalgam was introduced to avoid mechanical retention of the restorations. A mechanical retention requires proper cavity design and loss of more tooth structure whereas bonded restorations allows more sound tooth structure to be preserved [7].

In the year 1843, American Society of Dental Surgeons declared the use of dental amalgam to be malpractice due to the fear of mercury poisoning both in patients and dentists. Studies were done to assess the mercury level in urine of patients and dentists. This led to the emergence of amalgam war. Three amalgam wars have been reported in the years 1845, 1926 and 1980s respectively. Few patients have reported allergic reactions due to amalgam restorations [8].

The development of various tooth coloured cements and resins serves as an alternative and have reduced the use of amalgam. Glass ionomer cements preferably in children is used for biocompatibility, fluoride releasing property and ease of manipulation. Composites have made a complete change in the trend from extension for prevention to prevention of extension. Particularly flowable composites have become a versatile material in the restorative field [9]. They are highly preferred by both patients and dentists for the aesthetics and conservative cavity preparation. Among all these developments in restorative materials, amalgam still stands as one of the excellent restorative materials, some studies continue to support the position that dental amalgam is a safe restorative material [1]. Dental amalgam can be a good choice wherever caries extends towards root since composite restorations in those cases fails due to poor bonding to the dentin or cementum. In certain cases, secondary caries leads to involvement of pulp which ultimately goes for root canal treatment. We have numerous highly cited publications on well designed clinical trials and lab studies related with different aspects of management of deep caries and root canal treatment procedures [10-24]. Amalgam restorations are indicated wherever resistance against occlusal forces, microleakage and bonding failures are primarily affecting the lifespan of the restoration. This particular aspect of amalgam restorations has initiated a right platform for us to pursue the current study. Our aim is to perform a cross sectional survey among undergraduate students of a private dental school to assess knowledge, awareness and

practices about dental amalgam among dental students.

2. MATERIALS AND METHODS

2.1 Study Setting

Study was conducted as a cross sectional questionnaire based study among the dental students to find out the trend regarding dental amalgam. The study was conducted as an online survey as it is time saving.

Questionnaire:

1. Year of study
2. Gender
3. Source of knowledge about amalgam
4. Opinion on amalgam use
5. Criteria to choose amalgam as a restorative material
6. Do you educate your patient about amalgam and its adverse effect?
7. Why is amalgam not frequently used in clinical practice?
8. Preferred alternate restorative material
9. Opinion on amalgam as a restorative material.
10. Are you aware of the protocols for amalgam disposal?

2.2 Survey

Hundred participants of the same institution were involved in this online survey. The questionnaire were prepared after searching various aspects of dental amalgam which consist of ten questions and it was posted for an online survey using google forms. The validity of the questionnaire was cross verified by experts i.e guide, reviewer and researcher.

2.3 Data Collection and Tabulation

The data were extracted and tabulated in MS Excel sheets with respect to each question and their response.

2.4 Statistical Analysis

The data obtained were subjected to statistical analysis using SPSS software v20. Chi square test was done to assess the association between the variables. The statistical significance was set at 5%. The descriptive data obtained were plotted in bar graphs.

3. RESULTS

This study was a questionnaire based survey. An online survey link was shared and after few days the responses were collected. There were a total of 100 undergraduate participants who participated in the study.

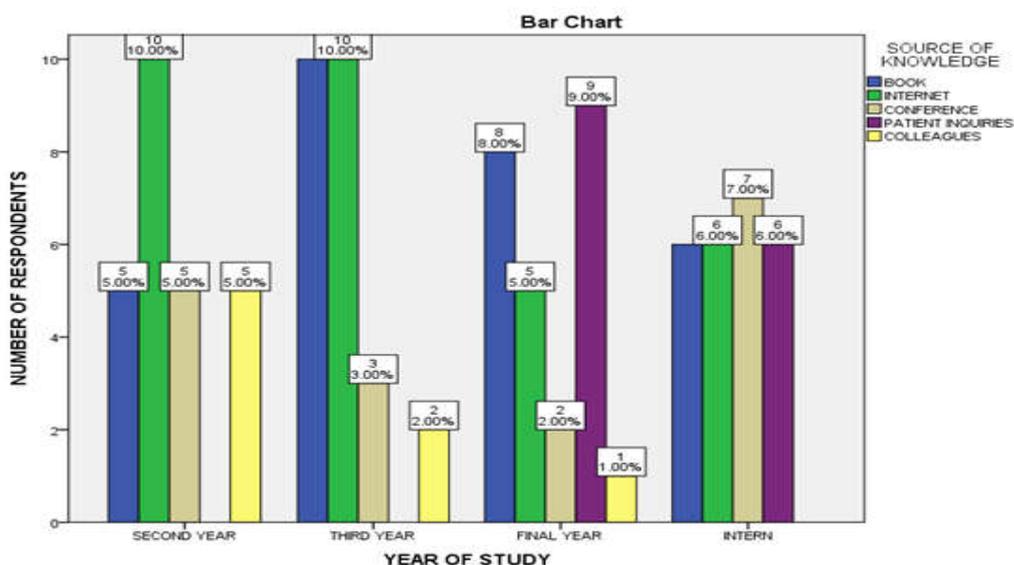
4. DISCUSSION

There were a total of 100 participants (55% females, 45% males). The association between gender and year of study revealed 13%, 17% 12%, 13% of second years, third years, final years and interns were females, 12%, 8%, 13%, 12% of second years, third years, final years and interns were males. The association between source of knowledge and the year of study was statistically not significant (p value = 0.497). The association between source of knowledge and year of study revealed that 5%, 10%, 8%, 6% of second years, third years, final years and interns respectively responded books, 10%, 10%, 5%, 6% of second years, third years, final years and interns respectively responded internet, 5%, 3%, 2%, 7% of second years, third years, final years and interns respectively responded conference, 9% and 6% of final years and interns responded through patient inquiries, 5%, 2%, 1% of second years, third year and final year responded colleagues (Graph 1). The association between source of knowledge and the year of study was statistically significant (p value = 0.002). The association between opinion on amalgam use and year of study revealed that 8%, 13%, 7%, 9% of second years, third years, final years and interns respectively responded safe, 11%, 8%, 8%, 11% of second years, third years, final years and interns respectively responded unsafe, 6%, 4%, 10%, 5% of second years, third years, final years and interns respectively responded uncertain (Graph 2). The association between opinion on amalgam and the year of study was statistically not significant (p value = 0.368). The association between the criteria to choose amalgam as a restorative material and year of study revealed 7%, 9%, 4%, 1% of second years, third years, final years and interns respectively responded older age, 2%, 3%, 10%, 11% of second years, third years, final years and interns respectively responded extend of caries, 7%, 10%, 6%, 11% of second years, third years, final years and interns respectively responded affordability, 9%, 3%, 5%, 2% of second years, third years, final years and interns respectively responded patients acceptance (Graph 3). The association between the criteria to choose amalgam and the year of study was

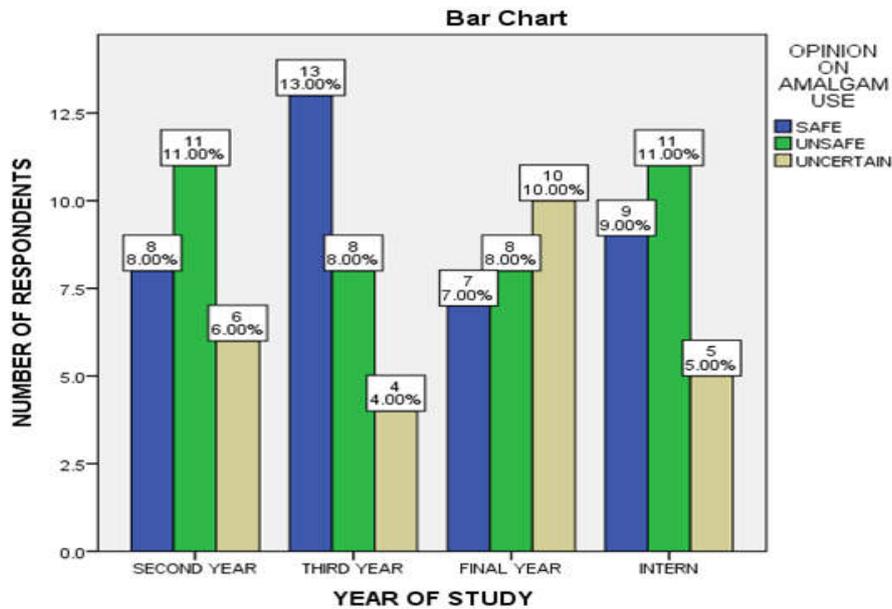
statistically significant (p value = 0.003). The association between educating the patient about amalgam and its adverse effects and year of study revealed that 16%, 13%, 11%, 20% of second years, third years, final years and interns respectively responded yes, 9%, 12%, 14%, 5% of second years, third years, final years and interns respectively responded no (Graph 4). The association between educating the patient about amalgam and its adverse effects and the year of study was statistically not significant (p value = 0.053). The association between why amalgam is not used frequently and year of study revealed 14%, 11%, 4%, 1% of second years, third years, final years and interns respectively responded high cost, 9%, 7%, 8%, 11% of second years, third years, final years and interns respectively responded aesthetic concern, 2%, 7%, 13%, 13% of second years, third years, final years and interns respectively responded alternate restorative material (Graph 5). The association between why amalgam is not used frequently and the year of study was statistically significant (p value = 0.001).

years and interns respectively responded composite, 14%, 8%, 13%, 10% of second years, third years, final years and interns respectively responded glass ionomer cement (Graph 6). The association between preferred alternate restorative material and the year of study was statistically not significant (p value = 0.299). The association between opinion on amalgam use and year of study revealed 5%, 6%, 10%, 18% of second years, third years, final years and interns respectively responded longevity, 8%, 9%, 7%, 2% of second years, third years, final years and interns respectively responded less technique sensitive, 12%, 9%, 7%, 5% of second years, third years, final years and interns respectively responded patient cooperation (Graph 7). The association between opinion on amalgam as a restorative material and the year of study was statistically significant (p value = 0.004). The association between awareness on amalgam disposal and year of study revealed 6%, 12%, 16%, 23% of second years, third years, final years and interns respectively responded yes, 19%, 13%, 9%, 2% of second years, third years, final years and interns respectively responded no (Graph 8). The association between awareness on amalgam disposal and the year of study was statistically significant (p value = 0.001).

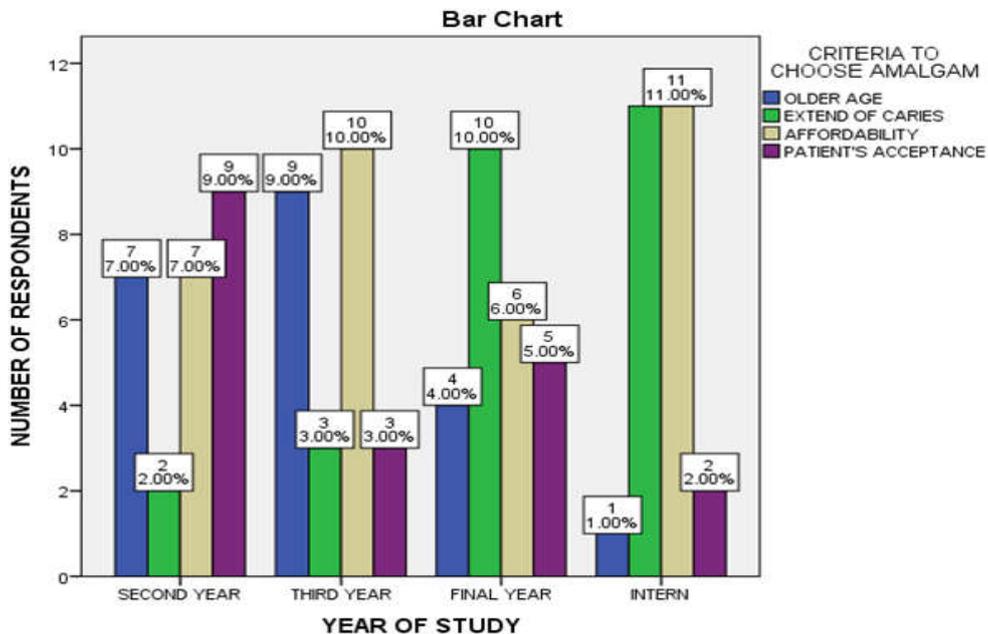
The association between preferred alternate restorative material and year of study. X axis represents the year of study revealed 11%, 17%, 12%, 15% of second years, third years, final



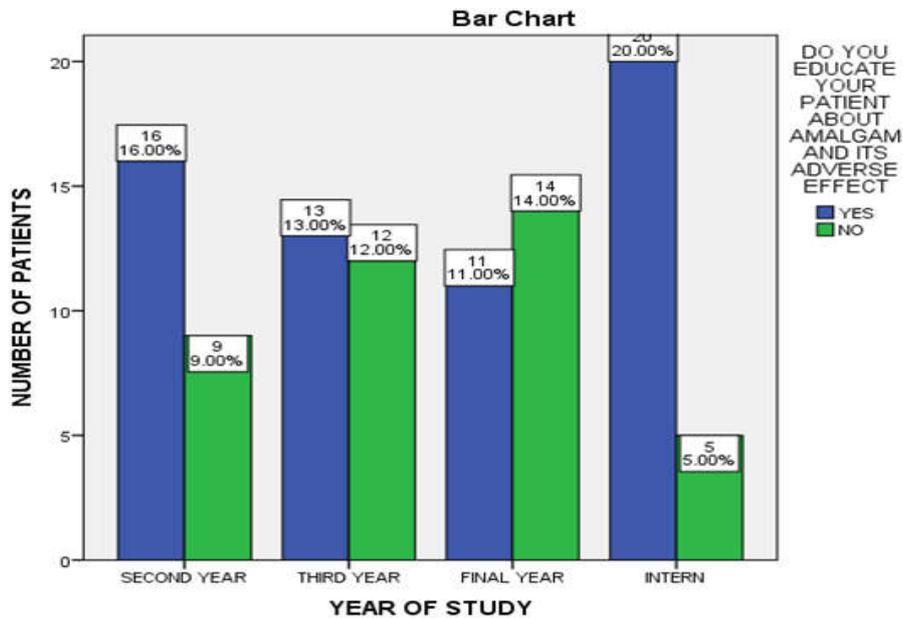
Graph 1. Represents the association between year of study and number of respondents regarding their source of knowledge on amalgam. X axis represents the year of study (second year, third years, final year, interns), Y axis represents the number of respondents. Chi square value = 31.382, df = 12, p value = 0.002 (< 0.05) - statistically significant. From the above Graph it can be inferred that the second and third years highly depend on the internet for sources of knowledge



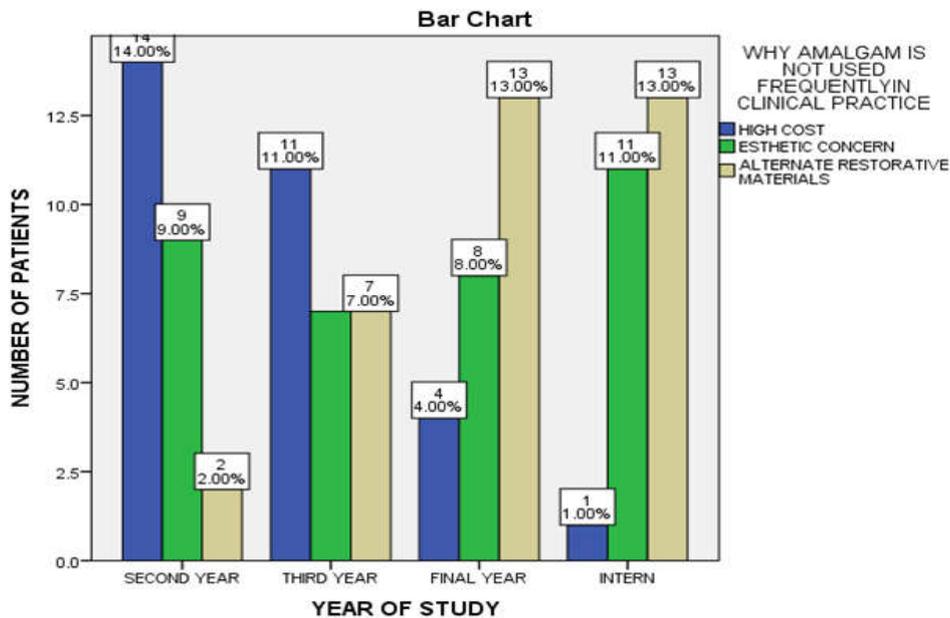
Graph 2. Represents the association between year of study and number of respondents regarding their opinion on dental amalgam. X axis represents the year of study (second year, third years, final year, interns), Y axis represents the number of respondents. Chi square value = 6.511, df =6 , p value = 0.368 (> 0.05) - statistically not significant. From the above Graph it can be inferred that the third years still felt that amalgam was safe while interns and second years were aware that amalgam was unsafe



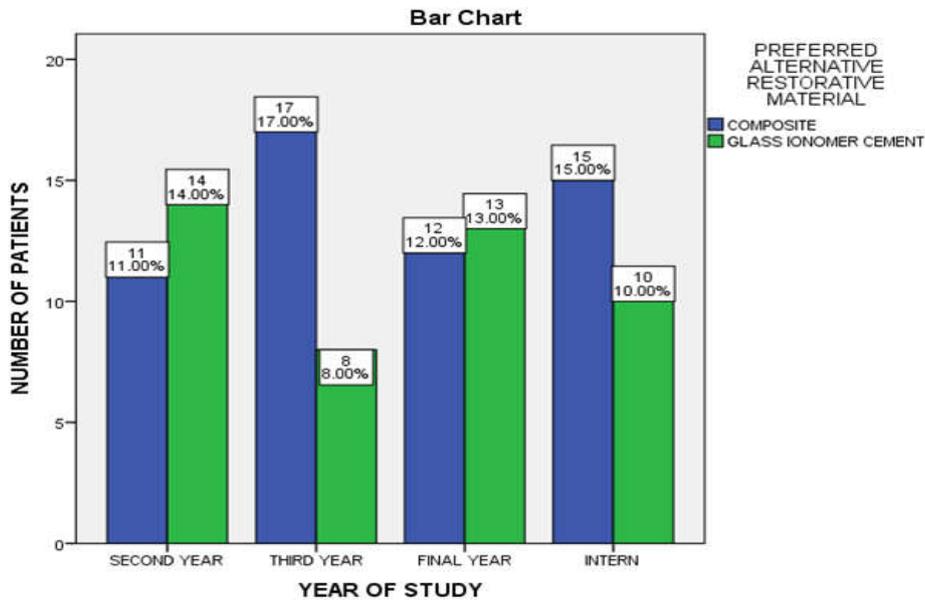
Graph 3. Represents the association between the year of study and number of respondents regarding the criteria to choose amalgam as a restorative material. X axis represents the undergraduate student with different clinical experience, Y axis represents the number of respondents. Chi square value =25.053, df =9 , p value = 0.003 (< 0.05) - statistically significant. From the above Graph it can be inferred that interns chose the type of restorative material based on the extent of caries and patients affordability



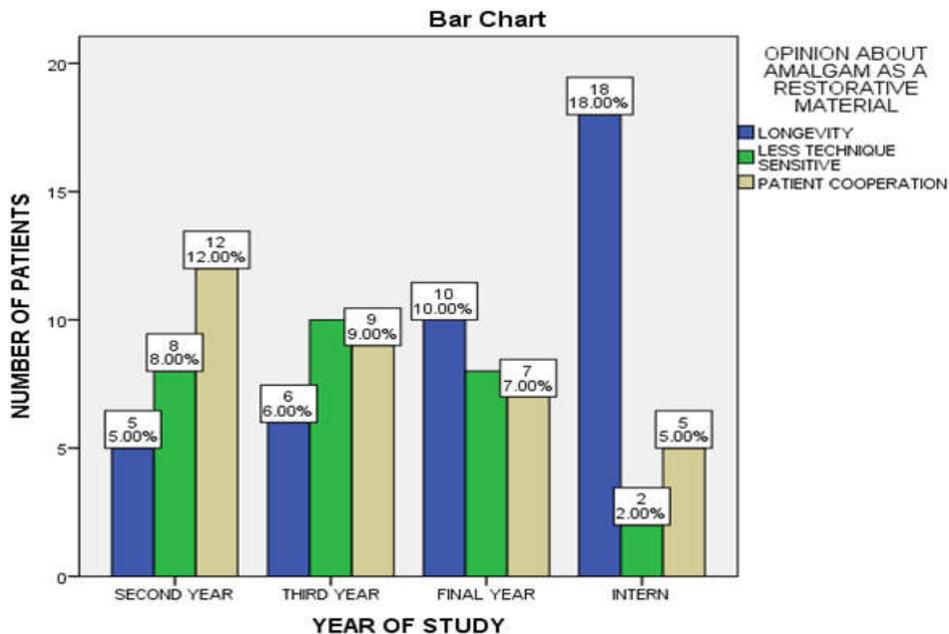
Graph 4. Represents the association between the year of study and number of respondents regarding the patient's education about amalgam and its adverse effect. X axis represents the undergraduate student with different clinical experience, Y axis represents the number of respondents. Chi square value =7.667, df =3, p value = 0.053 (> 0.05) - statistically not significant. From the above Graph it can be inferred that intern educate their patients about amalgam and its adverse effect



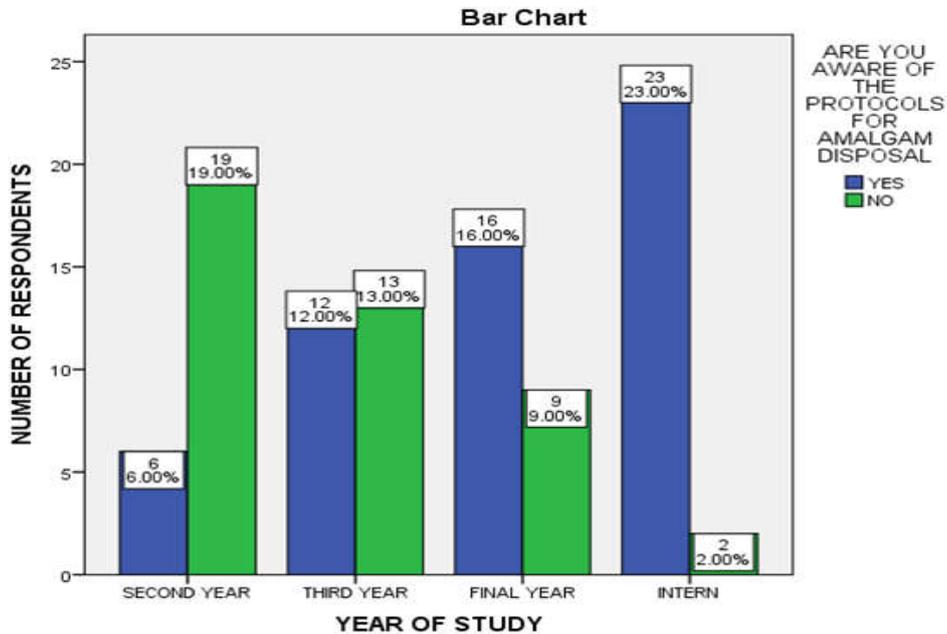
Graph 5. Represents the association between the year of study and number of respondents regarding why amalgam is not frequently used. X axis represents the year of study (second year, third years, final year, interns), Y axis represents the number of respondents. Chi square value =25.219, df =6, p value = 0.001 (< 0.05) - statistically significant. From the above Graph it can be inferred that second years have a misperception that amalgam is costly and hence not used frequently



Graph 6. Represents the association between preferred alternate restorative material and year of study. X axis represents the undergraduate student with various clinical experience, Y axis represents the number of respondents. Chi square test - Chi square value =3.677, df =3, p value = 0.299 (> 0.05). The association between preferred alternate restorative material and the year of study was statistically not significant. From the above Graph it can be inferred that most of the respondents used composite as an alternate restorative material



Graph 7. Represents the association between the year of study and number of respondents their opinion on amalgam as a restorative material. X axis represents the undergraduate student with different clinical experience, Y axis represents the number of respondents. Chi square value =19.129, df =6 , p value = 0.004 (< 0.05) - statistically significant. From the above Graph it can be inferred interns felt that the longevity of amalgam is one of the important factor to choose it as a choice of restoration



Graph 8. Represents the association between the year of study and number of respondents regarding their awareness on amalgam disposal. X axis represents the year of study (second year, third years, final year, interns), Y axis represents the number of respondents. Chi square value =24.929, df =3 , p value = 0.001 (< 0.05) - statistically significant. From the above Graph it can be inferred that interns were aware of the amalgam disposal protocols and most of the second years were not aware of the disposal protocols

The awareness about amalgam, its properties and its adverse effects among the respondents are adequate. There were equal ratios of students from each year, however gender distribution showed that most of the respondents were females. The source of knowledge about amalgam varied among students, but most of them acquired through the internet and books. Most of the interns felt the use of amalgam was unsafe, while a ratio of people were uncertain. This variation may be due to the disparity in the study population or lack of awareness [25]. Interns were aware that the choice of restorative material was based on the extension of caries and patients affordability, while second years responded it was based on age.

Most of the interns responded that they would educate their patients about amalgam, while third years and final years responded no. since a lot patients prefer replacement of amalgam restoration with tooth coloured restoration [26], dentists must educate the patient and should make them participate in an informed consent process before the placement of amalgam as well as during removal of the old amalgam [25]. Interns were aware of the alternate restorative materials used instead of amalgam and most of

them preferred the use of composite while a few of the preferred glass ionomer cement. Students preferred GIC for its fluoride releasing property and ease of manipulation and composite for its enhancement in aesthetics and micro-mechanical bonding [27,28]. Restoration using composites are aesthetically appealing and easy for the clinician. For instance occlusal stamp technique used in composite restoration make the restoration easy and aesthetically appealing [29].

However, the respondents agreed that the longevity and durability provided by amalgam is irreplaceable [30]. On discussing the disposal of amalgam, second years were less aware about amalgam about it, while interns had adequate knowledge. It is important to have an amalgam disposal kit in every clinic [31].

5. CONCLUSION

From the present study we can conclude that the interns had better knowledge about amalgam as they have more clinical experience compared to other groups. Second years had poor knowledge about amalgam since they are still undergoing their preclinical training. Most of them felt the use

of amalgam is unsafe, yet it remains controversial. However it is clear from above results that better clinical as well theoretical training is required to have a better understanding of uses of amalgam and its disposal at undergraduate level itself.

CONSENT AND ETHICAL APPROVAL

As per university standard guideline, participant consent and ethical approval have been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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