EVALUATION OF KNOWLEDGE, ATTITUDE AND PRACTICES OF INTERNS AND POSTGRADUATE DENTAL STUDENTS ON ADVANCED TREATMENT OPTIONS IN THE MANAGEMENT OF ENDODONTIC BIOFILM

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ABSTRACT

INTRODUCTION: A biofilm could be a highly organized structure consisting of bacterial cells enclosed during a self-produced extracellular polymeric matrix attached on a surface. Microbial biofilms within the infected root canal space are the first reason behind apical periodontitis. Root canal treatment therefore aims to either remove the biofilms from the foundation canal or kill all of the microbes within the biofilms. The aim of the study was to assess the knowledge, attitude and practices on advanced treatment options in the management of endodontic biofilm among internship and postgraduate students.

MATERIALS AND METHOD: A total of 100 practicing internship and postgraduate students were randomly chosen. The questionnaire was about knowledge, attitude and practice on advanced treatment options in the management of endodontic biofilm. The collected data was subjected to SPSS. Descriptive statistics was drawn with respective percentages to have a comparative overview.

RESULT : 24% consider only the factor time affects the development and characteristics of endodontic biofilm, 19% consider only the factor canal anatomy affects the development and characteristics of endodontic biofilm, 9% consider only the factor flora composition affects the development and characteristics of endodontic biofilm and 48% were aware that development depends on all three factors (p value: 0.525(> 0.05).24% of the respondents consider that the endodontic disinfection depends on chemical effectiveness, 22% of the respondents consider that it depends on Physical effectiveness and 54% of the respondents are aware that it depends on both and p value: 0.509 (> 0.05).

CONCLUSION

From the result we conclude that the dental students have adequate knowledge, attitudes and practices on advanced therapeutic treatment options in the management of endodontic biofilm. Post graduate dental students were better informed about the advanced therapeutic techniques than the internship dental students.

KEYWORDS: Root canal treatment, biofilm, infection, persister cells, advanced treatment, innovative technique

INTRODUCTION

Biofilms are sessile multicellular microbial communities where microbes are enmeshed in a self-made extracellular polymeric substance (EPS, usually a polysaccharide), and firmly attached to surfaces. These surfaces include root canal walls that provide a niche for bacteria. (1) However, predicting success usually requires adopting a referential or criteria, and presupposes that the patient is healthy(2). It's estimated that RCT should be considered completed when the tooth is permanently restored and in function(3). RCT clinical success is analyzed and supports different points of view, with specific values that involve the dentist, the patient or the tooth itself(4). References for the dentist are the worth of symptoms (clinical silence - absence of pain), the worth of image (root canal space completely stuffed with no evidence of periapical inflammation), and also the value of clinical condition (a well-restored and functioning tooth)(5). The dentist's skills are crucial to correctly interpret the radiographic features and establish a diagnostic hypothesis(6,7). For the patient, the worth of symptoms (no pain) is important. Except for this, RCT success is related to predictive aspects that eliminate the requirement of interventions and establish treatment conclusions(8,9). The success for the tooth itself is related to absence of disease (root canal infection or periapical inflammation)(10). The lifetime of an endodontically treated tooth implies understanding that biological and

mechanical events have a multifactorial nature and can't be viewed separately(6). Ideally, it's expected to preserve the most important possible number of teeth until the top of life. Successful RCT prevents pain, apical periodontitis (AP) and tooth loss, but it's a true challenge because several clinical conditions can contribute, alone or together, for a poor prognosis, namely passage perforation, overfilling, endodontic and periodontal lesion, root fracture, periapical biofilm, traumatic dental injury, fracture of instrument, AP, root resorption, etc.(8)

A biofilm could be a highly organized structure consisting of bacterial cells enclosed during a self-produced extracellular polymeric matrix attached on a surface(11). Biofilms might also be considered as a layer of condensation of microbiota or a microbial-derived community consisting of cells that are irreversibly attached to a substratum or interface or to every other, and embedded during a matrix of extracellular polysaccharides additionally to extracellular DNA (eDNA) and extracellular proteins. In general, the precise composition varies with the microorganisms and nutrients available(12). The organisms within the biofilms exhibit an altered phenotype with relevancy rate and gene transcription(13). The process of passage treatment involves enlarging the foundation canal with instruments and cleaning the space using chemical disinfectants to (i) remove remnant vital or necrotic tissues; (ii) kill the microbiota within the basis canal system, including disruption of the microbial biofilm and (iii) remove the accumulated hard tissue debris that's formed during passage instrumentation. In general, the aim of any disinfection strategy in healthcare is to cut back the bacterial load to a subcritical level in order that the patient's response will allow healing. passage treatment isn't any different where passageway disinfection is taken into account the pivot of this therapy(12,13).

Endodontic treatment is fairly predictable in nature with reported success rates up to 86–98%. However, there has not been a consensus within the literature upon the same definition of "success" criteria of endodontic treatment(14). Likewise "failure" has variable definitions. It's been defined in some studies as a recurrence of clinical symptoms together with the presence of a periapical radiolucency(12,15). An endodontically treated tooth should be evaluated clinically likewise as radiographically for its passage treatment to be deemed successful. The normal factors which might be attributed to endodontic failure are: Persistence of bacteria (intra-canal and extra-canal), Inadequate filling of the canal (canals that are poorly cleaned and obturated), Overextensions of root filling materials, Improper coronal seal (leakage), Untreated canals (both major and accessory), Iatrogenic procedural errors like poor access cavity(12). Microbial biofilms within the infected root canal space are the first reason behind apical periodontitis(16). Root canal treatment therefore aims to either remove the biofilms from the foundation canal or kill all of the microbes within the biofilms(17,18). Instrumentation mechanically removes or disrupts biofilm organization and creates sufficient space within the canal to permit effective irrigation and disinfection to occur(17). While none of the mechanical or chemical factors alone can predictably eradicate the infective agents, their combined action under optimal efforts is the key factor for long-term success of endodontic treatment and healing of the lesion. Endodontic infection is caused by the surface-associated growth of microorganisms. Applying the biofilm concept to endodontic microbiology helps to know the pathogenic potential of the foundation canal microbiota and to create the premise of recent approaches in passage disinfection. Recent developments in biocompatible intracanal medicaments including synthetic HBDs and L. plantarum LTA could open up new avenues as a perfect therapeutic agent to eradicate endodontic biofilm. Previously our team had conducted numerous studies which include clinical trials(19)(20)(20,21)(20–23)(24)(25)(26)(27)(28,29)(30)n vitro studies(20–22)(30–32)and (28)case reports. The aim of the study is to assess knowledge, attitude and practices on advanced treatment options in the management of endodontic biofilm among internship and postgraduate dental students.

MATERIALS AND METHOD

A cross sectional study was conducted among postgraduate and internship dental students in a dental institution. This was done in the form of a questionnaire that was circulated online. The dental students were of the age group 18 to 25 years. The study protocol was approved by the institutional review board and the questionnaire was validated. The sample size of this study was 100. The questionnaire consisted of 10 questions that mainly focused on knowledge, awareness and practice of armamentarium used in endodontic surgery among undergraduate dental students. The questionnaire was distributed among the students through an online survey website called google forms. The data was collected, compiled and was arranged in a systematic manner and was analysed according to SPSS software.The Pearson Chi Square test was also done. The confidence interval was found to be 95% and statistical significance of $p<0.05$. The independent variable of the study was gender. The results were then represented in the form of pie charts and bar charts.

Inclusion criteria:

The participants should be dental students.

Exclusion criteria:
Students who were not available to take the survey.
Students who were not willing to participate.
Dentists who had completed the period of study.

Study Setting:
The study was conducted with the approval of the Institutional Ethics Committee. The study consisted of one assessor and one guide .

Study method:
Self administered questionnaire of 10 close-ended questions was prepared and was validated by the Institutional Review Board(IRB). The questionnaire was distributed among undergraduate dental college students of private dental college institutions through an online survey form "GOOGLE FORMS" . Demographic details were also included in the questionnaire.

Sampling Technique:
The study was based on a non probability consecutive sampling method.
Ethical considerations:
Returning the filled questionnaire was considered as implicit consent with no need for signing for a return consent. Ethical approval of study is obtained from the Institutional Review Board (IRB).

Statistical analysis:
Data was analysed with the SPSS version (22.0). Descriptive statistics as number and percent were calculated to summarize qualitative data. Chi square test was used to analyze and compare the education level of students and their knowledge, attitude and practise on armamentarium for endodontic surgery among undergraduate dental students. The confidence level was 95% and the statistical significance $p < 0.05$ was considered statistically significant. Finally the results were represented by using bar charts and frequency tables.

RESULTS
The results of the study are presented as bar diagrams below. 48% of internship students and 52% of PG students (figure: 1). 72% of students are aware that persister cells are the non growing phenotypic variants of the general cell population (figure: 2). 48% of students are aware that all the factors affect the development and characteristics of endodontic biofilm (figure: 3). 54% of the respondents are aware that it depends on both (figure: 4). 40% of students were aware that dentin structure, bacterial biofilm , anatomy of root canal influence the disinfection of endodontic biofilm (figure: 5). 43% of students consider both are the advanced therapeutic strategies for endodontic biofilms (figure: 6). 56% of students consider both methods to be an antibiofilm strategy (figure: 7). The associated graph represents that Majority of the post graduates were aware that all the three factors influence the development and characteristics of biofilm (figure: 8). The associated graph shows that Majority of the postgraduate students were aware that final efficiency of endodontic disinfection depends on physical and chemical effectiveness (figure: 9).

DISCUSSION
One role of root canal irrigation is to assist in killing the bacteria and also the removal of the bacterial biofilm from uninstrumented surfaces (30-50% found on the canal wall). Antimicrobial irrigating solutions and other locally used disinfecting agents and medicaments play a key role within the eradication of microbes(33). A perfect irrigant should have high efficacy against microorganisms in biofilms while being systemically non-toxic and non-caustic to periodontal tissues. Although current irrigation regimens using sodium hypochlorite (NaOCl) exhibit excellent antimicrobial activity, caustic and toxic effects to vital tissues are often noted. There is a requirement for agents that are both antibacterial and exert minimal tissue-irritating effects. Previous studies have shown that instrumentation and antibacterial irrigation with NaOCl would eliminate bacteria in 50-75% of the infected root canals at the top of the primary treatment session. Whereas the remaining root canals contain recoverable bacteria(34). Bacterial etiology has been confirmed for common oral diseases like caries and periodontal and endodontic infections. Bacteria causing these diseases are organized in biofilm structures, which are complex microbial communities

composed of a good sort of bacteria with different ecological requirements and pathogenic potential(13). The biofilm community not only gives bacteria effective protection against the host weapons system but also makes them more immune to a spread of disinfecting agents used as oral hygiene products or within the treatment of infections (9). Successful treatment of those diseases depends on biofilm removal likewise as effective killing of biofilm bacteria. Because bacteria causing endodontic infections are mostly found within the main passage, chemo-mechanical debridement plays a key role in treating endodontic infections. Chelating agents are accustomed to remove the smear layer produced during mechanical instrumentation. Although ethylenediaminetetraacetic acid (EDTA) is one in all the foremost commonly used agents, its antimicrobial activity against biofilms could be a matter of some controversy. Malic acid (MA), a light organic acid, has been more recently proposed to be used as a final irrigating solution, as an alternative to EDTA. Malic acid has shown better smear layer removal from the apical third of the root canal system with lesser toxicity. Furthermore, its antibacterial activity has been shown in vitro against E. faecalis biofilm. Different protocols and/or combinations of irrigating solutions are employed in the ultimate irrigation of the root canals, but their residual activity isn't well-known.

Microorganisms grown within biofilms are 1,000–1,500 times more proof against antimicrobials than planktonic bacteria [6,19]. NaOCl has been widely used as an endodontic irrigant thanks to its potent antimicrobial action and necrotic tissue dissolving property. Regarding the recalcitrant bacteria, mostly Enterococcus faecalis (E. faecalis) biofilm, it had been reported that treatment of E. faecalislipoteichoic acid (LTA) with NaOCl resulted within the impairment of immunostimulating activity by the delipidation of glycolipid moiety structure. NaOCl could impair toll-like receptor 2 activation of E. faecalis and induce inflammatory mediators, and damage the LTA structure, potentially through deacylation. Furthermore, NaOCl is the simplest antimicrobial irrigant against multi-species biofilm as long as the dual-species biofilms or the aged biofilms were more proof against NaOCl than monospecies biofilms or the young biofilms. Many researchers found that prime concentration NaOCl was the sole irrigant effective in disrupting multi-species biofilm and eradicating bacterial cells.

The root canal biofilm could be a very complex, organized entity and it's difficult, but not impossible to duplicate its characteristics in in vitro experiments. Within root canal systems, the complexity isn't only associated with the character of the biofilm, but also the complex anatomy, which houses tissue together with biofilms and removal of such biomasses is as relevant as having the ability to kill bacteria in biofilms. It's important to use the biofilm concept to endodontic microbiology to grasp the pathogenic potential of the basis canal microbiota furthermore on form the premise for brand spanking new approaches for disinfection. It's foremost to grasp how the biofilm formed by root canal bacteria resists endodontic treatment measures. From this we conclude that students have adequate knowledge, attitudes and practices on advanced therapeutic treatment options in the management of endodontic biofilm.

CONCLUSION

Within the limitations of the study, we conclude that the dental students have adequate knowledge, attitudes and practices on advanced therapeutic treatment options in the management of endodontic biofilm. Post graduate dental students were better informed about the advanced therapeutic techniques than the internship dental students.

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CONFLICT OF INTEREST

All the authors declare no conflict of interest in the study.

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RESULT

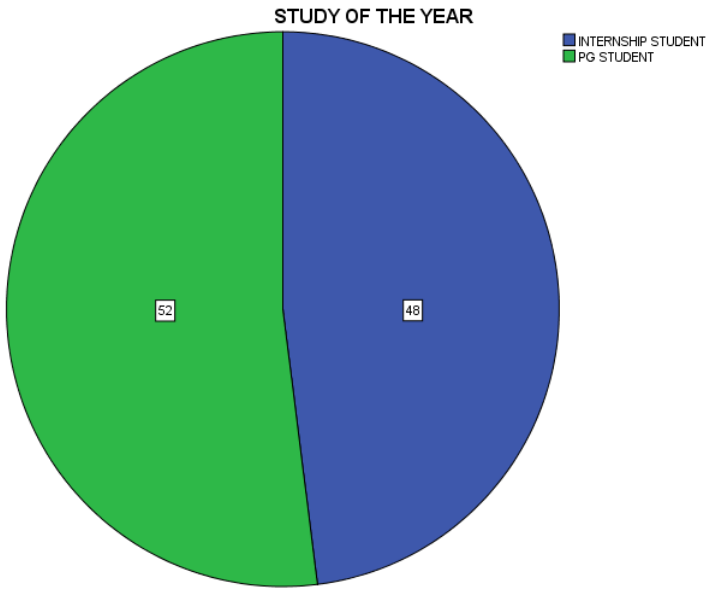

Figure1: Pie chart represents distribution of students in the study based on year of study. Blue colour denotes internship students (48%) and Green colour denotes post graduate students(52%).

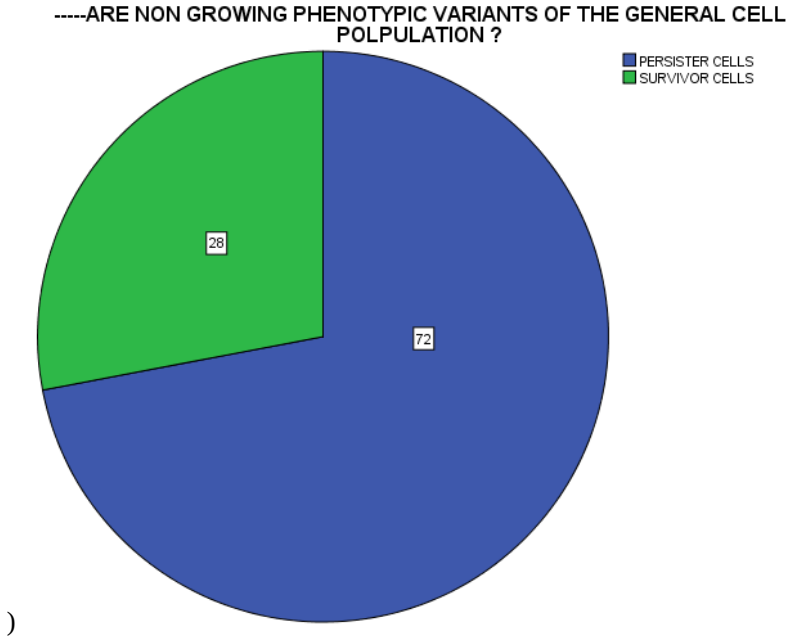

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Figure 2: Pie chart shows that 72% (blue colour) of students are aware that persister cells are the non growing phenotypic variants of the general cell population.

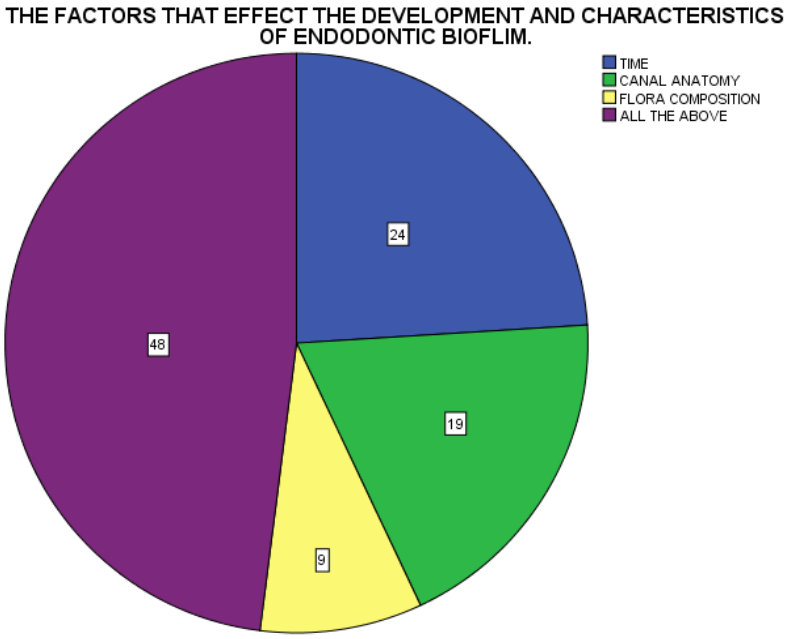

Figure 3: Pie chart shows that 24% (blue colour) consider only the factor time affect the development and characteristics of endodontic biofilm, 19% (green colour) consider only the factor canal anatomy affect the development and characteristics of endodontic biofilm, 9% (yellow colour) consider only the factor flora composition affect the development and characteristics of endodontic biofilm and 48% (violet) are aware that all the factors affect the development and characteristics of endodontic biofilm.

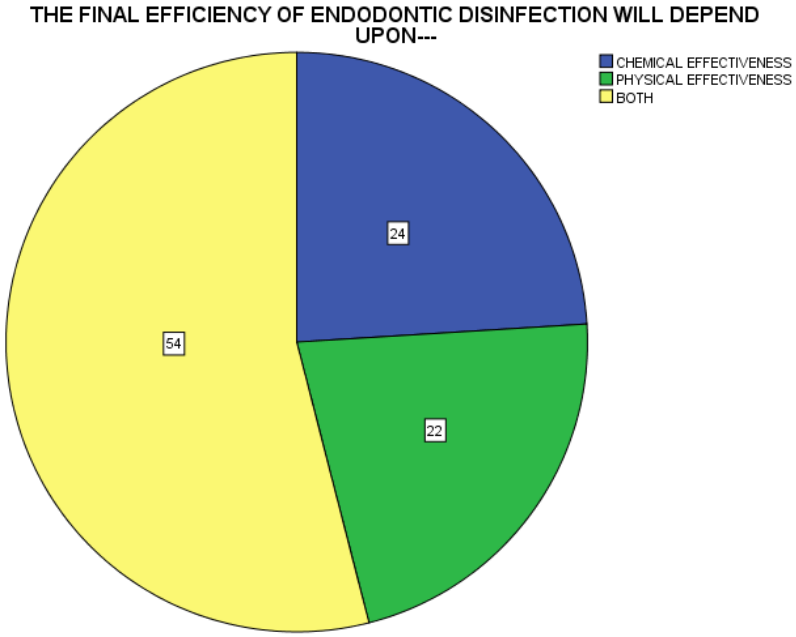

Figure 4: Pie chart shows the responses of the final efficiency of endodontic disinfection will depend upon. 24% of the respondents consider that the endodontic disinfection depends on chemical effectiveness, 22% of the respondents consider that it depends on Physical effectiveness and 54% of the respondents are aware that it depends on both and p value: 0.509 (> 0.05).

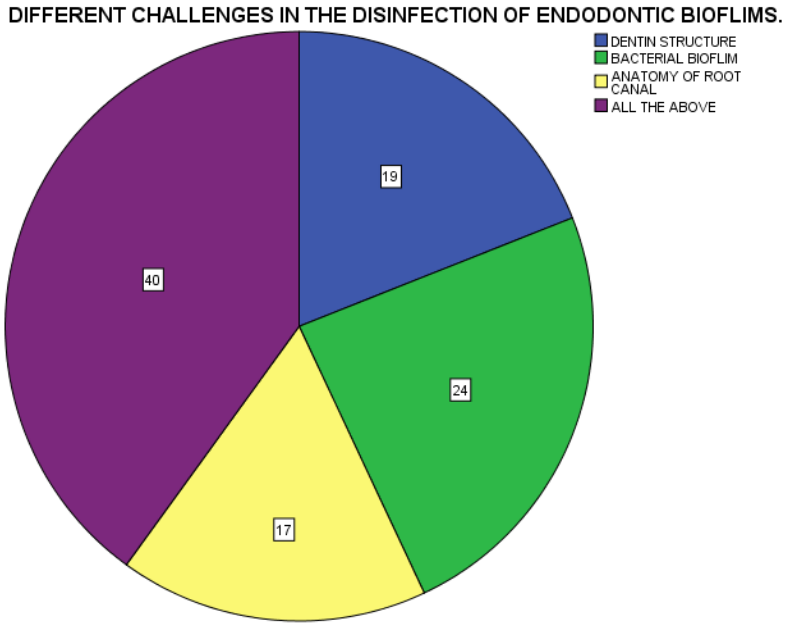

Figure 5: Pie chart showing knowledge on different challenges in the disinfection of endodontic biofilm. 40% (violet colour) were aware that dentin structure, bacterial biofilm , anatomy of root canal influence the disinfection of endodontic biofilm, 24% (green colour) consider only bacterial biofilm on challenges in the disinfection of endodontic biofilm, 19% (blue colour) consider only dentin structure on challenges in the disinfection of endodontic biofilm, 17% (yellow colour) consider only anatomy of root canal on challenges in the disinfection of endodontic biofilm.

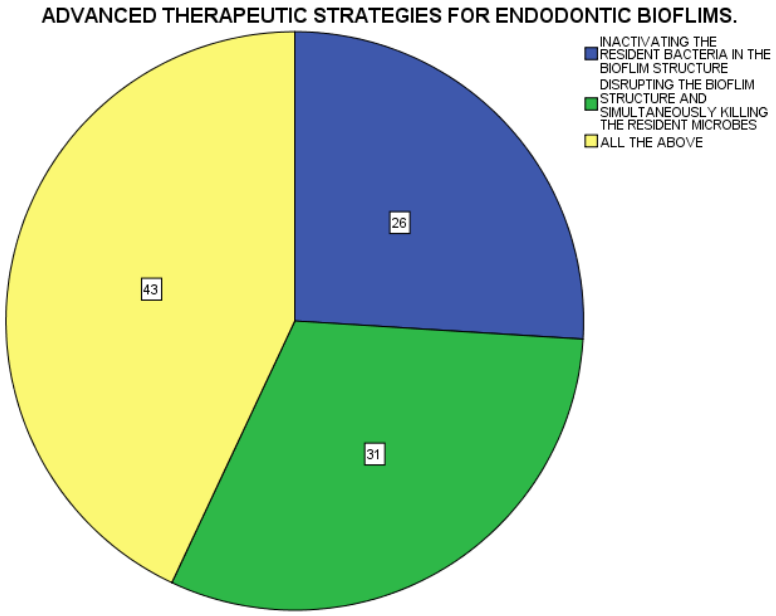

Figure 6: Pie chart showing the awareness on advanced therapeutic strategies for endodontic biofilms, 26% (blue colour) consider inactivating the resident bacteria in the biofilm structure, 31% (green colour) consider disrupting the biofilm structure and simultaneously killing the resident microbes and 43% (all the above) consider both are the advanced therapeutic strategies for endodontic biofilms.

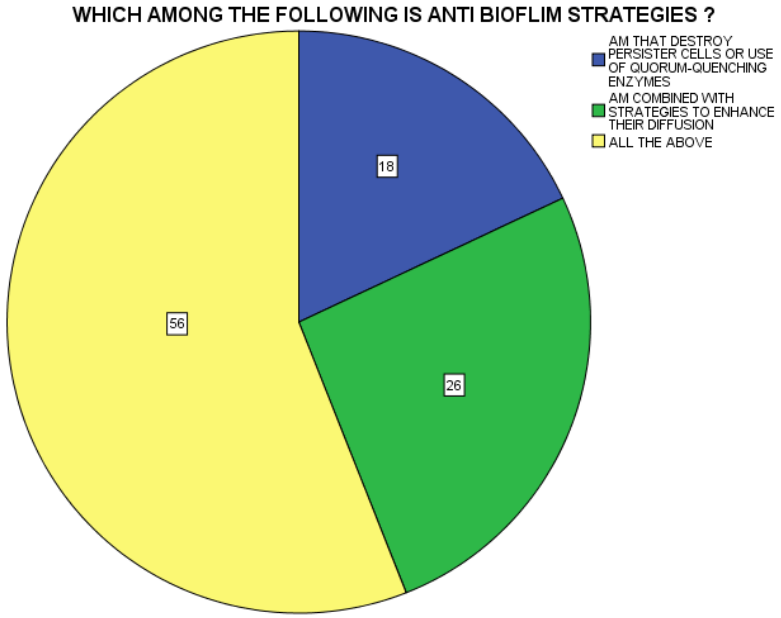

Figure 7: Pie chart showing the awareness on antibiofilm strategies. 18% (blue colour) consider AM that destroy persister cells or use quorum quenching enzymes, 26% consider AM combined with other strategies to enhance their diffusion and 56% consider both methods to be an antibiofilm strategy.

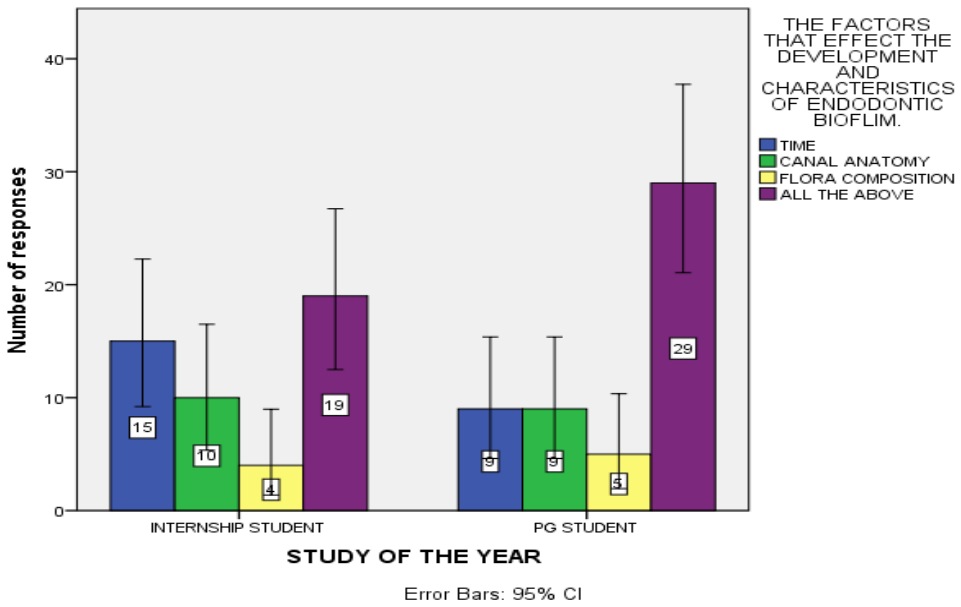

Figure 8: Bar graph represents association of the year of study and number of responses for the factors that affect the development and characteristics of endodontic biofilm . The X-axis represents different years of study and Y-axis represents the number of responses. Blue denotes time, green colour donates canal anatomy, yellow colour donates flora composition and violet colour donates all the above. Majority of the post graduates were aware that all the three factors influence the development and characteristics of biofilm. Pearson's chi square: 0.404 , DF: 1 , p value: 0.525(> 0.05) and found to be statistically not significant.

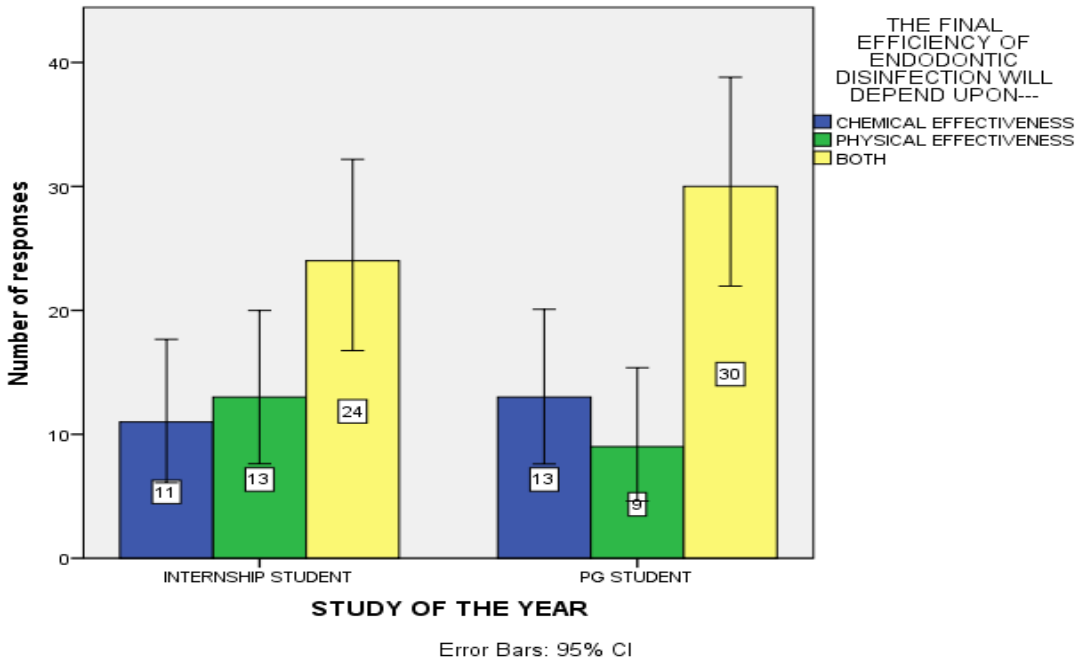

Figure 9: Bar graph represents association of year of study and number of responses for the final efficiency of Endodontic disinfection will depend upon. The X-axis represents different studies of the year and Y-axis represents the number of responses. Blue denotes chemical effectiveness, green colour donates physical effectiveness, yellow colour donates both. Majority of the postgraduate students were aware that final efficiency of endodontic

disinfection depends on physical and chemical effectiveness. Pearson's chi square: 0.436, DF: 1, p value: 0.509 (> 0.05) and found to be statistically not significant.