Knowledge, Attitude And Practice Based Survey About Variations In Root Canal Anatomy Among The Undergraduate Students

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Abstract
Introduction: Root canal treatment is a type of endodontic procedure that consists of steps such as cleaning , shaping, disinfection and obturation of root canals followed by the last step which is sealing of the pulp cavity. To perform a successful root canal treatment, one should know about the tooth structure, variations in root canal anatomy.
Aim: The aim of the study is to determine the knowledge, attitude and practice based survey about variations in root canal anatomy among the undergraduate students.
Materials and methods: Self-administered questionnaire was prepared based on variations in root canal anatomy and distributed among dental students through an online survey link. The sample size was about 106 undergraduate students. The data was statistically analysed with the SPSS software. Pearson chi square test was done to find the correlation between year of study and knowledge about root canal anatomy variations with ($p<0.05$) as significant.
Results and Discussion: In this study, 99.1% of the participants were aware about the variations in root canal anatomy. The entire population responded that understanding of the tooth anatomy is very important in root canal treatment. The p-value-0.00[<0.05] obtained was found to be statistically significant.
Conclusion: The present study concludes that the knowledge, attitude and practice based survey about variations in root canal anatomy among the undergraduate students was moderate.

Keywords: Innovative technology; Knowledge; practice; root canal anatomy; undergraduates; variations.

Introduction

Root canal treatment is a type of endodontic procedure that consists of steps such as cleaning , shaping, disinfection and obturation of root canals followed by the last step which is sealing of the pulp cavity [1]. This treatment is done when the infection extends upto pulp including nerve, blood vessels and cellular constituents. Removal and sealing of the pulp which is infected helps to preserve the function and sustainability of the tooth. The lifespan of an endodontically treated tooth can withstand and prevent pain, apical periodontitis and loss of tooth but in severe conditions after treatment they can contribute to poor prognosis [2]. The important aim of root canal treatment is to reduce the number of microorganisms which includes removal of all contents of the root canal and then proceeding with shaping [3]. Pain originating endodontically is a nightmare for so many people and it is believed to be one of the most painful dental procedures[4]. Another aim of this treatment is to prevent coronal leakage. Post operative pain begins and almost flares up which forms a poor indicator of success in the long run [5].

To perform a successful root canal treatment, one should know about the tooth structure, variations in root canal anatomy and common variability among different shapes of root canals seen in different teeth. Hence, knowledge about working variations of root canal anatomy is necessary for a dental practitioner [6]. In some cases, lack of knowledge about variations and complications of morphology of root canal causes higher failure rates of endodontic procedures [7]. Cone beam computed tomography (CBCT) plays a major role in forming an effective diagnostic tool by providing high quality three dimensional images of high resolution [8].

Our team has extensive knowledge and research experience that has translate into high quality publications[9–18][19–23]. The aim of this study is to determine the knowledge, attitude and practice based survey about variations in root canal anatomy among the undergraduate students.

Materials and methods

This was a survey conducted among undergraduates. Self administered questionnaire was taken based on variations in the root canal anatomy. The questionnaire (close ended questions) was circulated through an online survey link. The questionnaire included demographic data also. SPSS software was used to obtain statistical results. Pearson chi square test was done to find the correlation between year of study and knowledge about root canal anatomy variations. The method of representation of results was presented by pie charts and bar diagrams.

Results

Table 1: Depicts the percentage response on Knowledge, attitude and practice about variations in root canal anatomy among the undergraduate students

S.No	Question	Choice	Response
1.	Year of study	1st year 2nd year 3rd year 4th year 5th year	15.09% 42.45% 19.81% 8.49% 14.15%
2.	Why is root canal treatment done?	When tooth pulp is affected When the infection is extending till dentin	98.11% 1.89%
3.	What is the main aim of doing a root canals treatment?	Sealing of pulp Cleaning and irrigating the pulp canal	92.45% 7.55%
4.	Do you think understanding the tooth anatomy is very important in root canal treatment?	Yes No	100% -
5.	Are you aware of different variations in root canal anatomy?	Yes No	99.06% 0.94%
6.	What is the most common type of GP points used for filling the root canal?	Non-standardised Gutta percha points(beta) Standardised Gutta percha points	56.60% 43.40%
7.	Why are standardised points best for filling lateral and accessory root canals?	These are manufactured in coherence to accommodate tapered canals They are very flexible than non standardised GP points	39.62% 1.89%

		Both	58.49%
8.	What do you think has the most number of variations in their root canal anatomy?	Maxillary 1st molar Mandibular 1st molar Mandibular 2nd premolar All of the above	22.64% 26.42% 1.89% 49.06%
9.	What do you think is the most common variation in the root canal anatomy of maxillary first molar?	Presence of 2 mesial canals Presence of 2 palatal canals Presence of distal canals All of the above	35.85% 1.89% - 62.26%
10.	Which single rooted teeth do you think shows the presence of multiple canals ?	Maxillary central incisors Mandibular central incisors Maxillary and Mandibular 2nd premolars All of the above	26.42% 21.70% 5.66% 46.23%
11.	What do you think is the most common variation in the root canal anatomy mandibular second molar?	C shaped canal Extra distal canal Single canal All of the above	33.96% 0.94% - 65.09%
12.	Are you aware of Krasner and Rankow's Laws of Access Opening?	Yes No	94.34% 5.66%
13.	If Yes, which law/s help in determining the presence of an extra orifice?	Law of CEJ Law of Symmetry 1 Law of orifice location 3	23.58% 6.60% 69.81%
14.	Are you aware of Vertucci's classification of root canals?	Yes No	94.34% 5.66%
15.	How often do you make an attempt to look for an	Always	64.15%

	extra canal in these teeth?	Sometimes Never	33.02% 2.83%
16.	Do you feel you require more education regarding this topic?	Yes No Maybe	82.08% 0.94% 16.98%

Among 106 participants, 69.81% were male and 30.19% were female. 42.45% of the participants were second year undergraduates, 19.81% were third year undergraduates, 15.09% were first year undergraduates, 14.15% were interns and the remaining 8.49% were first year undergraduates. Among 106 participants, almost 98.11% responded that root canal treatment is done when the tooth pulp is affected and the remaining 1.89% responded that root canal treatment is done when the infection is extending till dentin. 98.11% of the participants answered that tooth pain and sensitivity is the main sign for root canal treatment whereas 1.89% answered that grossly decayed tooth is the main sign. 92.45% and 7.55% of the participants responded that sealing of pulp and cleaning and irrigating the pulp canal is the main aim of doing a root canal treatment respectively. The entire population responded that understanding of the tooth anatomy is very important in root canal treatment. 70.75% of the participants felt that operators inability to identify canals can be the common mistake during root canal treatment. 27.36% and 1.89% felt irregularity in the pulpal space and perforation of the tooth surface can be the common mistake respectively. In the present study, 86.79% of the population responded that CBCT is the effective diagnostic tool to analyse the root canal shape. 7.55% and 5.66% responded that intraoral apical and bitewing radiographs were effective diagnostic tools for analysing root canal shape respectively. 56.60% of the population answered that non standardized gutta percha points were the most common type of GP points used for obturation whereas 43.40% of the population answered that standardized gutta percha points are used more commonly. 58.49% of the participants answered that standardised points are used because of both flexibility and as they are coherent for accommodation of tapered canals, 39.62% answered because of coherence for accommodation of tapered canals and remaining 1.89% answered because of their flexibility. 22.64% of the respondents felt that the maxillary first molar shows the most number of variations in root canal anatomy. 26.42% and 1.89% of them answered mandibular first molar and mandibular second premolar respectively and showed maximum variations. 49.06% of respondents felt that all of the above mentioned teeth show maximum variations. 35.85% of the population answered that presence of 2 mesial canals is the most common variation in the root canal anatomy of maxillary first molar and 1.89% answered that presence of 2 palatal canals. 62.26% answered that all of the above mentioned were the most common variations in the root canal anatomy of maxillary first molar. 26.42% and 21.70% of the population answered that maxillary central incisors and mandibular central incisors were the single rooted teeth to show presence of multiple canals respectively. Remaining 5.66% answered that maxillary and mandibular second premolar shows presence of multiple canals. 46.23% felt all of the above mentioned teeth show presence of multiple canals. 33.96% of the population responded that C shaped canal and 0.94% responded that extra distal canal is the most common variation in mandibular second molar and 65.09% responded that C shaped, extra distal, single canals were the common variation in the root canal anatomy of mandibular second molar . 94.34% were aware and 5.66% were not aware about Krasner and Rankow laws of access opening. About 69.81% answered that Law of orifice location 3 helps in determining the presence of an extra orifice. 23.58% answered that Law of CEJ and 6.60% answered that Law of symmetry 1 helps in determining the presence of an extra orifice . 94.34% were aware and 5.66% were not aware about Vertucci's classification of root canals. As undergraduates, 64.15% answered that they always make an attempt to look for an extra canal in the tooth, 33.02% answered that they sometimes look for an extra canal and 2.83% answered that they don't take any attempt to look for an extra canal. 82.08% of the participants felt that they required more education regarding this topic, 16.96% felt they needed more education and the remaining 0.94% felt that they did not require more education regarding this topic (Table-1).

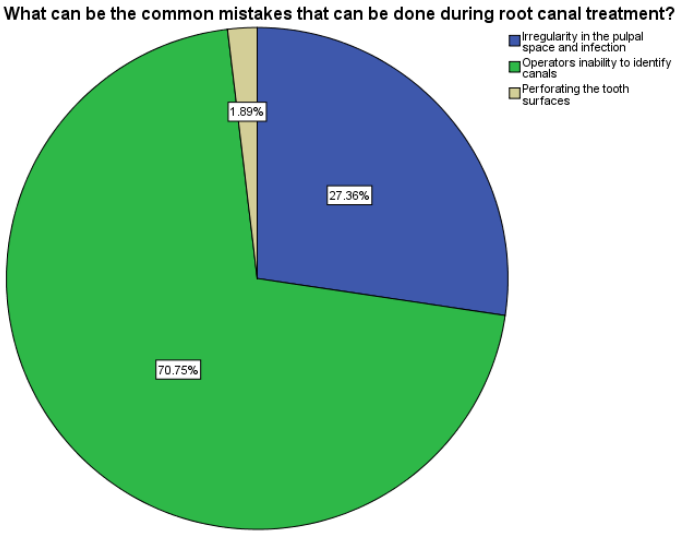

Figure-1: Pie chart showing the responses for common mistakes during root canal treatment where blue denotes irregularity in the pulpal space and infection, green denotes operators inability to identify canals and beige denotes perforating the tooth surfaces. 70.75% of the participants responded that operators inability to identify canals.

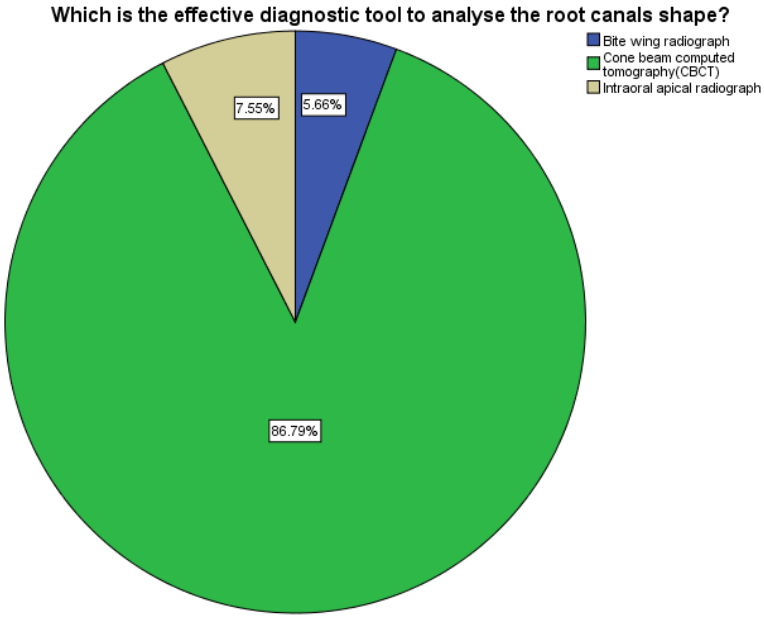

Figure-2: Pie chart showing the responses about the effective diagnostic tool for analysing root canal anatomy where blue denotes bite wing radiograph, green denotes cone beam computed tomography(CBCT) and beige denotes intraoral apical radiograph. 86.79% of the participants responded that CBCT is the effective diagnostic tool for analysing root canal anatomy.

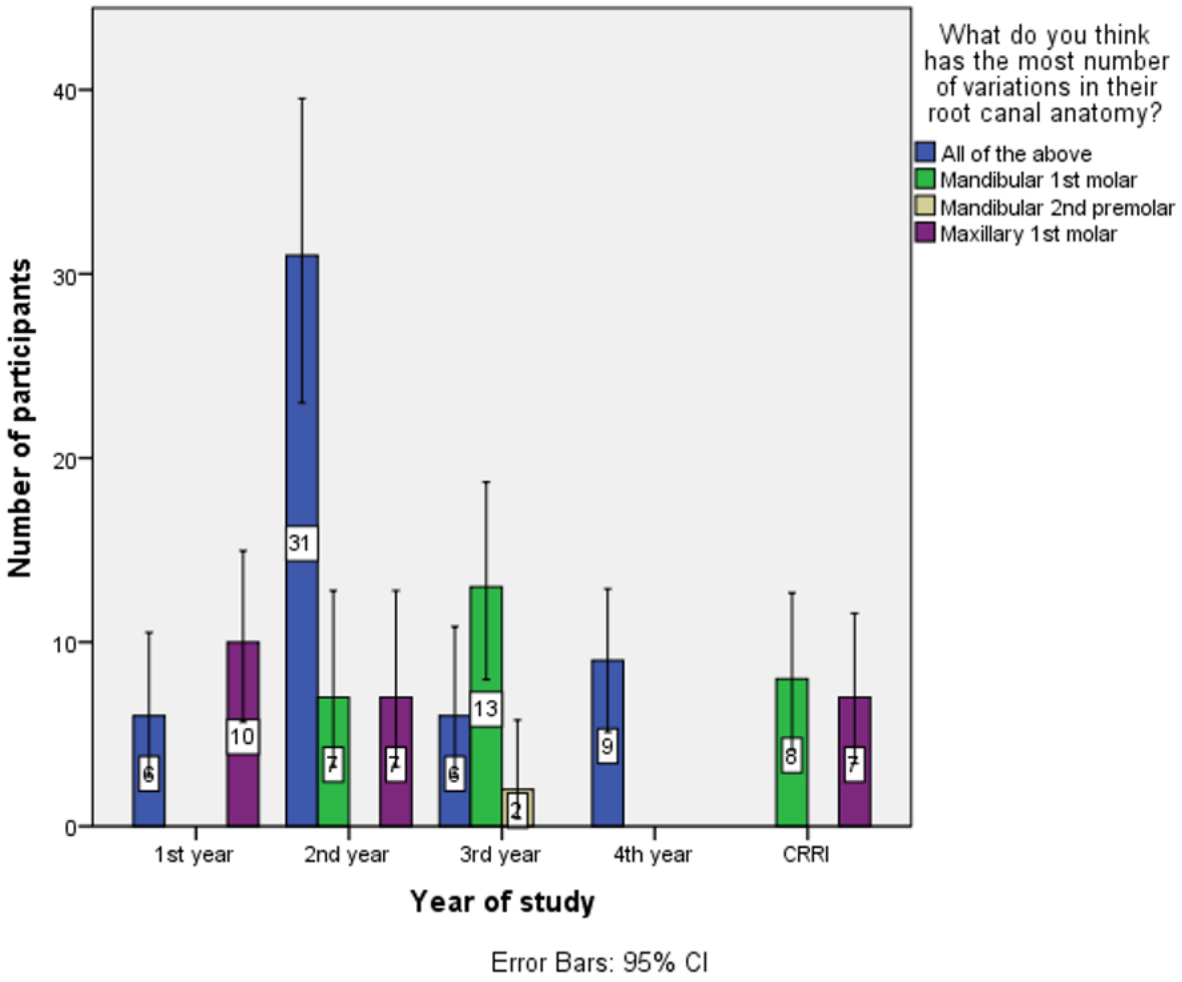

Figure-3: Bar graph depicting the association between year of study and knowledge about which tooth has the most number of variations. X-axis represents the year of study and Y-axis represents the number of participants. The colour blue denotes all of the above, green denotes mandibular first molar, beige denotes mandibular second premolar. (Pearson Chi square value-71.637, P-value-0.00[<0.05]-statistically significant). Out of 106 participants, 6 participants from the first year, 31 participants from second year, 6 participants from third year, 9 participants from fourth year responded to all of the above.

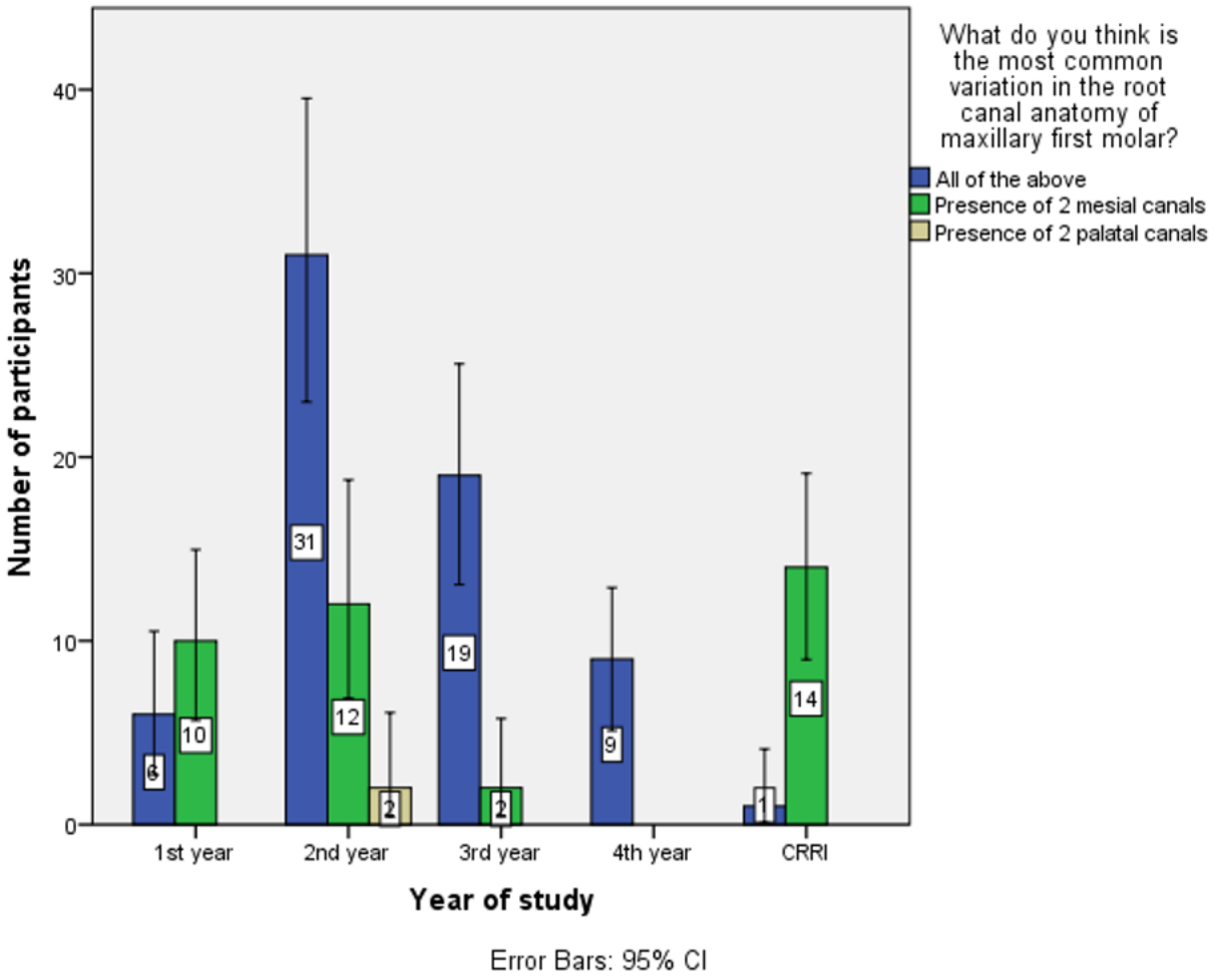

Figure-4: Bar graph depicting the association between year of study and knowledge about the most common variation of maxillary first molar. X-axis represents the year of study and Y-axis represents the number of participants. The colour blue denotes all of the above, green denotes presence of 2 mesial canals and beige denotes presence of 2 palatal canals. (Pearson Chi square value-42.135, P-value-0.00[<0.05]-statistically significant). Out of 106 participants, 6 participants from the first year, 31 participants from second year, 19 participants from third year, 9 participants from fourth year and 14 participants from interns answered for all of the above.

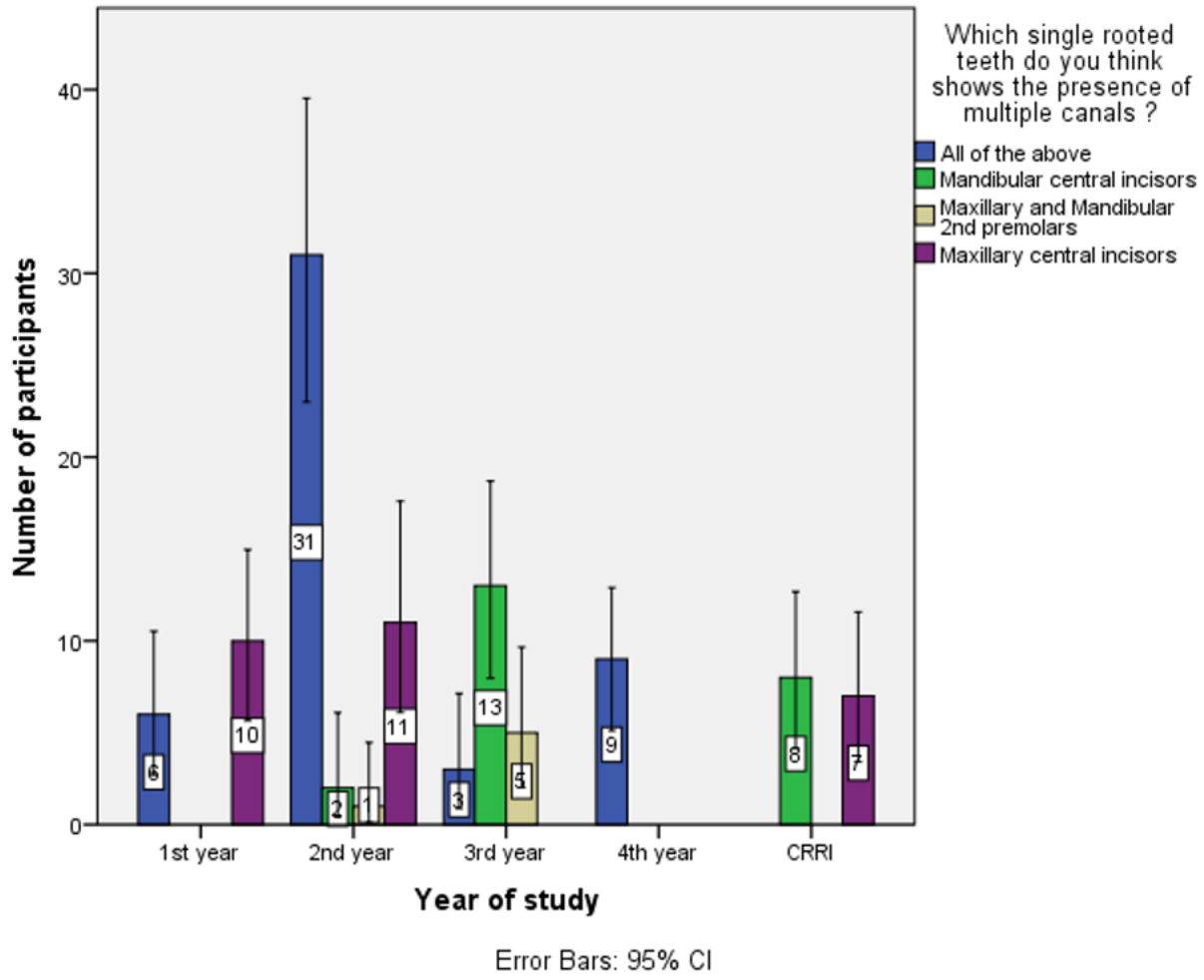

Figure-5: Bar graph depicting the association between year of study and knowledge about which single rooted tooth has the presence of multiple canals. X-axis represents the year of study and Y-axis represents the number of participants. The colour blue denotes all of the above, green denotes mandibular central incisors, beige denotes maxillary and mandibular second premolars and purple denotes maxillary central incisors. (Pearson Chi square value-90.255, P-value-0.00[<0.05]-statistically significant). Out of 106 participants, 6 participants from the first year, 31 participants from second year, 3 participants from third year, 9 participants from fourth year answered all of the above.

Discussion

70.75% of the participants felt that operators inability to identify canals can be the common mistake during root canal treatment. 27.36% and 1.89% felt irregularity in the pulpal space and perforation of the tooth surface can be the common mistake respectively (Figure-1). In a previous study by Mehak et al., 37.08% answered that radiograph and case history correlation acts as the best tool for analysing root canal [24]. In the present study, 86.79% of the population responded that CBCT is the effective diagnostic tool to analyse the root canal shape. 7.55% and 5.66% responded that intraoral apical and bitewing radiographs were effective diagnostic tools for analysing root canal shape respectively (Figure-2).

Among 106 participants, almost 98.11% responded that root canal treatment is done when the tooth pulp is affected and the remaining 1.89% responded that root canal treatment is done when the infection is extending till dentin. 92.45% and 7.55% of the participants responded that sealing of pulp and cleaning and irrigating the pulp canal is the main aim of doing a root canal treatment respectively. The entire population responded that understanding of the tooth anatomy is very important in root canal treatment. In the study by Talal et al., 71.1% were aware of root canal anatomy[25]. 99.06% of the population were aware about the different variations in root canal anatomy and the remaining 0.94% were not aware about the different variations in root canal anatomy. 56.60% of the population answered that non standardized gutta percha points were the most common type of GP points used for obturation whereas 43.40% of the population answered that standardized gutta percha points are used more commonly. 58.49% of the participants answered that standardised points

are used because of both flexibility and as they are coherent for accommodation of tapered canals, 39.62% answered because of coherence for accommodation of tapered canals and remaining 1.89% answered because of their flexibility (Table-1).

22.64% of the respondents felt that the maxillary first molar shows the most number of variations in root canal anatomy. 26.42% and 1.89% of them answered mandibular first molar and mandibular second premolar respectively and showed maximum variations. 49.06% of respondents felt that all of the above mentioned teeth show maximum variations. In the study by G Slaus et al.,70% of the population responded that the mesial canal is a variation in maxillary first molar [26]. 35.85% of the population answered that presence of 2 mesial canals is the most common variation in the root canal anatomy of maxillary first molar and 1.89% answered that presence of 2 palatal canals. 62.26% answered that all of the above mentioned were the most common variations in the root canal anatomy of maxillary first molar. 26.42% and 21.70% of the population answered that maxillary central incisors and mandibular central incisors were the single rooted teeth to show presence of multiple canals respectively. Remaining 5.66% answered that maxillary and mandibular second premolar shows presence of multiple canals. 46.23% felt all of the above mentioned teeth show presence of multiple canals. In the previous study, 39.2% responded that C shaped, extra distal, single canals were the common variation in the root canal anatomy of the mandibular second molar [27]. 33.96% of the population responded that C shaped canal and 0.94% responded that extra distal canal is the most common variation in mandibular second molar and 65.09% responded that C shaped, extra distal, single canals were the common variation in the root canal anatomy of mandibular second molar (Table-1).

In the previous study, 56.5% were aware about Krasner and Rankow laws of access opening [27]. 94.34% were aware and 5.66% were not aware about Krasner and Rankow laws of access opening. About 69.81% answered that Law of orifice location 3 helps in determining the presence of an extra orifice. 23.58% answered that Law of CEJ and 6.60% answered that Law of symmetry 1 helps in determining the presence of an extra orifice. 94.34% were aware and 5.66% were not aware about Vertucci's classification of root canals (Table-1) ..

In the association between year of study and knowledge about which tooth has the most number of variations, out of 106 participants, the majority 31 participants from second year responded all of the above (Figure-3). In the association between year of study and knowledge about the most common variation of maxillary first molar, out of 106 participants, majority 31 participants from second year answered for all of the above (Figure-4). In the association between years of study and knowledge about which single rooted tooth has the presence of multiple canals, out of 106 participants, 6 participants from the first year, 31 participants from second year, 3 participants from third year, 9 participants from fourth year answered all of the above (Figure-5).

In the present study, there was less knowledge about variations in root canal anatomy by undergraduates. In a previous study by K Doshi et al., it was inferred that many dentists were aware of the variations in root canal anatomy of maxillary first molars and it was found that the attitude and practice among dentists is poor [27].

The limitations of the study is that the survey was conducted among undergraduates of a private institution with a limited sample size. This survey can be used as a reference for future studies with a wider range of population.

Conclusion

The present study concludes that the knowledge, attitude and practice based survey about variations in root canal anatomy among the undergraduate students was moderate. More education regarding this topic is necessary for increased efficiency in root canal treatment provided by the undergraduates.

Authors contribution

Srivatchava.S - Contributed to conception, design, data acquisition and interpretation, drafted and critically revised the manuscript.
Harish Selvaraj - Contributed to conception, design, and critically revised the manuscript.
All authors gave final approval and agreed to be accountable for all aspects of the work.

Conflicts of Interest

The authors declare that there are no conflicts of interest in the present study.

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