RESEARCH ARTICLE

ASSESSMENT OF KNOWLEDGE ON ROOT CANAL ANATOMY AMONGST DENTAL STUDENTS

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ARTICLE INFO	ABSTRACT
	Aim: The aim of this survey is to assess the knowledge on root canal anatomy amongst dental students. OBJECTIVE: To conduct a survey amongst dental students of a private dental school about the variations of root canal morphologies and the methods of detecting them. **Background:** A clear understanding of the root canal anatomy of the human dentition is a prerequisite for successful endodontic treatment. The past decade has seen a varied use of methods for detecting the canal configuration. Hence, the student's knowledge about these was questioned in this survey. **Reason:** This survey was conducted to assess the knowledge of the students and to make them understand about the importance of root canal anatomy and its variations. This helps them in achieving a successful endodontic treatment.

INTRODUCTION

A successful Endodontic treatment stems from locating, cleaning, shaping and 3 dimensional obturation of the entire canal system. Occurrence of aberrant canal configurations, accessory canals, bifurcations, isthmuses, and anastomoses are often difficult to identify, thus causing incomplete cleaning and shaping. (Grossman *et al*., 1988) The frequency of missing anatomy are strictly linked with the complexity of the root canal system; thus good knowledge of the potential aberrant canal morphology in maxillary and mandibular teeth will help clinicians to successfully recognise and treat these difficult cases. Also awareness about the variations in tooth anatomy among various racial groups is vital. (Ahmed *et al*.,) There are numerous reports on the root canal morphologies of different populations, which is extremely important for an Endodontist as well as general dental practitioners. (Sperber, 1990) Several studies have been made on the various methods of analysing the canal morphologies. (Cleghorn *et al*., 2006) The most commonly used methods are canal staining and tooth clearing (Vertucci, 1978; Alavi *et al*., 2002; Awawdeh *et al*., 2008) conventional radiographs (Pineda and Kuttler, 1972; Weine *et al*., 1999; Pattanshetti *et al*., 2008), digital and contrast medium–enhanced radiographic techniques (Fan *et al*.,

2008; Patel *et al*., 2009) radiovisiogram (RVG) (Hua *et al*., 2012) and most commonly used computed tomographic techniques (Plotino *et al*., 2006; Fan *et al*., 2008; Sberna *et al*., 2009). Canal staining and tooth clearing were considered as gold standard in these studies. Weng *et al*. (2009) proposed a modification to this technique which makes it accurate, feasible and non destructive. CT scanning has been suggested as the preferential imaging modality in difficult situations demanding localisation and description of root canal systems because of its ability to render 3D information. (Patel and Horner, 2009; La *et al*., 2010; Bornstein *et al*., 2009) But how far these methods are being used in clinical practise and student's awareness about all the methods is still unsure. Thus, in this study we have mentioned about the various in vitro and in vivo methods of analysing the canal configuration and asked their opinion about the most accurate method. Also, we have tried to correlate their clinical experience with their theoretical knowledge.

MATERIALS AND METHODS

A pre-piloted questionnaire was prepared and distributed to 100 students of a private dental school. The students were not obliged to return the pro forma. The data was collected using a structured, self-administered questionnaire which was formulated after reviewing the recent literature and similar questionnaires. The basis of this study was to assess the knowledge of the students about the morphology of root canals.

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The questionnaire included their opinion about the accuracy of the various in vitro and in Vivo methods of identifying root canals, and also about the variations in root canal configurations. The questionnaire was anonymous. The data was then collected and tabulated. Statistical data was formulated and the percentage of the corresponding data was derived.

RESULTS

In accordance to the survey results, out of 100 students, 35% were 3rd year undergraduate students, 28% were 4th year under graduate students, 24% were interns and 13% were post graduate students. The dental students were asked if according to them, knowledge about root canal anatomy is vital for all dentists, to which 86% felt that knowledge about root canal morphology was vital for all dentists whereas the remaining 14% felt it was unnecessary. 35% of the students opted CBCT as the most accurate method for detecting root canals. The remaining 33% and 32% chose conventional radiography and RVG respectively. In regards to digital radiography, 43% of the students preferred CBCT whereas the remaining 57% felt that the others methods were not as accurate. 41% of the students preferred RVG whereas a disappointing 7% and 9% preferred Spiral CT and Micro CT respectively. This indicates their lack of experience and knowledge about Spiral and Micro CT. With regards to accuracy of in vivo method, 47% of the students opted for longitudinal and cross sectional sectioning method. And the remaining students opted for modified canal clearing and staining method and visualisation radiogram.

Table 1. General opnion about root canal anatomy

Do you think knowledge about root canal anatomy is vital for all dentists?	GENDER					
	MALE		FEMALE		TOTAL	
	N	%	N	%	N	%
a) YES	42	87.5	44	84.6	86	86%
b) NO	6	12.5	8	15.3	14	14%

Table 2. Comparison of the various methods of analysing root canal morphology

Which method of detecting the root canal morphology is most accurate?	YEAR OF STUDY				
	III year BDS (%)	IV Year BDS (%)	Intern (%)	MDS (%)	Total (%)
a)Conventional radiograph	36.3	33.3	24.2	6.06	33
b)RVG	56.2	18.7	18.7	6.25	32
c)CBCT	14.2	31.4	28.5	25.7	35
TOTAL STUDENTS	35	28	24	13	100

Table 3. Most accurate method

Questions	Options	Feedback (%)
Among digital radiography which is accurate.		
	a) RVG	41
	b) CBCT	43
	c) SPIRAL CT	7
	d) MICRO CT	9

Questions	Options	Feedback (%)
Under in vitro method, which is most accurate?		
	a) Modified canal clearing and staining method	37
	b) Longitudinal and cross sectioning staining	47
	c) Visualisation Radiogram	16

When the students were asked if they had observed or done modified canal staining method, unexpectedly 62% gave a negative response. This method has been considered as the gold standard for most of the scientific study on the variation of root canal morphology.
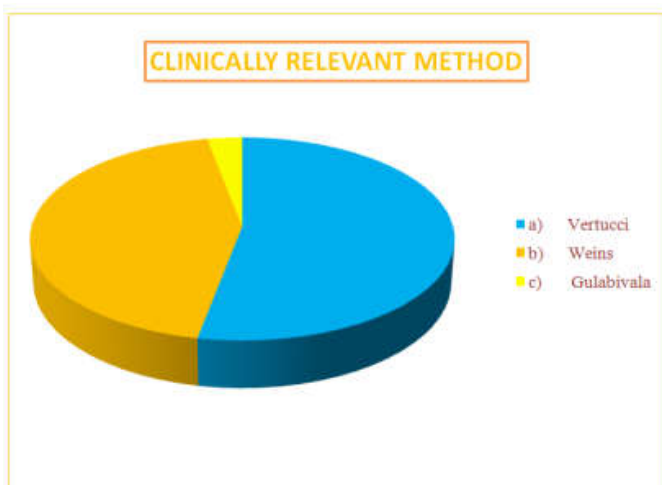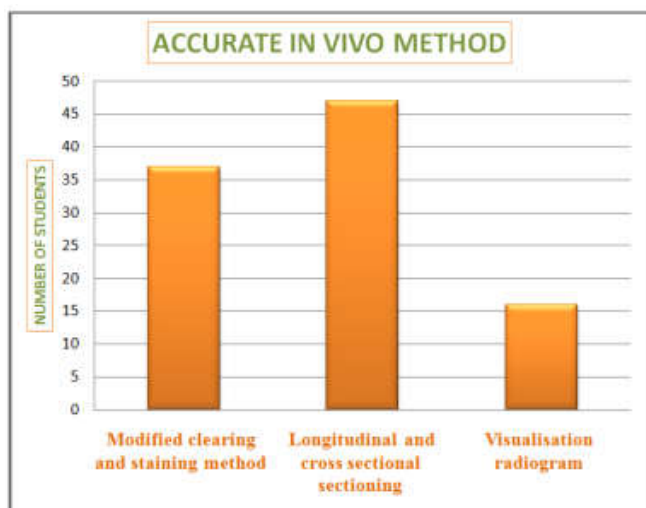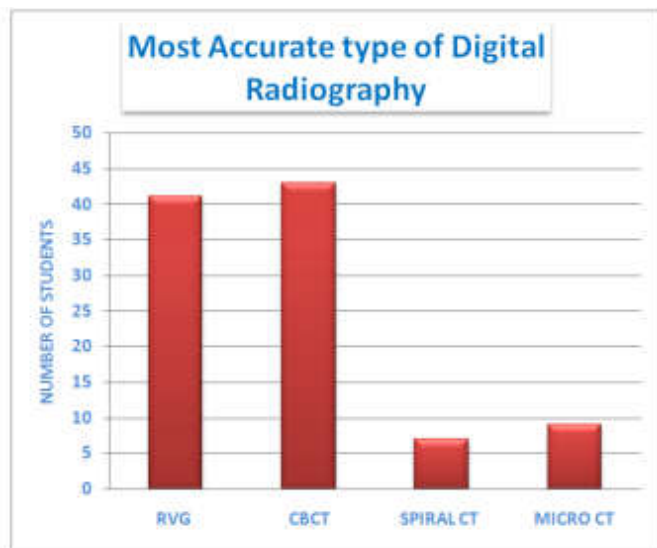
Table 4. Experience of the students in handling complex root canal morphologies

Questions	Options	Feedback (%)
1) Ever performed or seen anyone performing modified canal clearing and staining method		
	a) YES	38
	b) NO	62
2) Ever come across any variations other than those classified under Vertucci's?		
	a) YES	46
	b) NO	54
3) Which method of classification is clinically relevant?		
	a) Vertucci	53
	b) Weins	44
	c) Gulabivala	3
4) Have you attempted Root canal treatment? If yes, ever missed out any canal during your treatment?		
	a) YES	24
	b) NO	76
5) If yes, which method of detecting root canal anatomy was used to find the missing canal?	YES = 24%	CBCT = 34.5 IOPA = 29.16 RVG = 33.3

STUDENTS OPINION ABOUT THE TOOTH SHOWING HIGHEST VARIATION
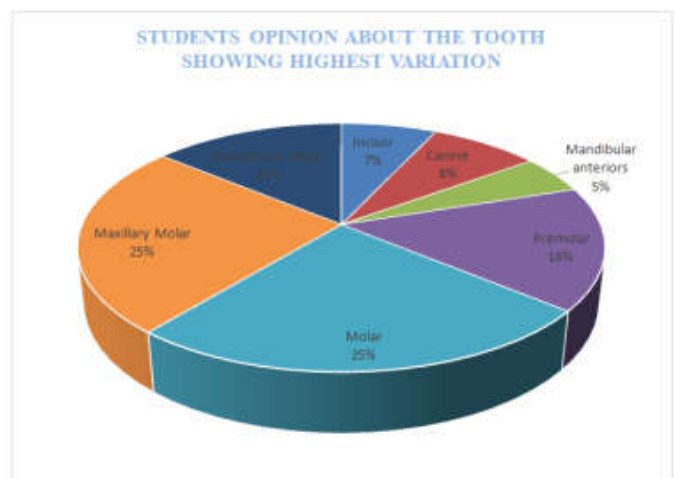
All the questionnaires had performed root canal treatment; they were asked if they had observed any variations other than Vertucci's classification. 54% of the respondents observed variations. With regards to RCT, 24% of the respondents had missed identifying canals. When they were asked on what

method they had used to find those missing canals, 34.5% used CBCT, 29.16% used IOPA and 33.3% RVG. A general question on the tooth with maximum root canal variation observed wide variation in the response; 64% told molars had maximum variations and the remaining 36% gave other responses.

Most Accurate type of Digital Radiography

ACCURATE IN VIVO METHOD

CLINICALLY RELEVANT METHOD

- a) Vertucci
- b) Weins
- c) Gulabivala

DISCUSSION

The aim of endodontic treatment is the elimination of infection from the root canal and prevention of secondary infections.

(Sjögren *et al*., 1990) Morphological features of the tooth can affect endodontic procedures adversely. (Nair *et al*., 1990) Many clinicians have the perception that a given tooth will contain a specific number of roots and/or canals. A thorough knowledge of anatomic variations is essential because endodontic success is related to a thorough debridement of the root canal system. Clinicians therefore should be aware of anatomical variations in the teeth they are managing, and should never assume that canal systems are simple. (D'Arcangelo *et al*.,) Digital radiographs are more accurate than conventional radiographs in analyzing root canal anatomy has been observed in several studies. According to the survey result, only 35% opted CBCT to be most accurate when compared to Conventional radiograph and RVG. Over the past few years micro-CT systems have been used for the evaluation of the root canal morphology because of its high resolution and its non-destructive nature (Lee *et al*., 2006; Gao *et al*., 2009; Gu *et al*., 2010; Yu *et al*., 2006; Plotino *et al*., 2006; Rhodes *et al*., 1999), furthermore it allows the observer evaluating the complete root canal system in different planes simultaneously or separately (Plotino *et al*., 2006; Rhodes *et al*., 1999; Gu *et al*., 2010). For these reasons micro-CT is the best technology available now and might be functioned as a gold standard (Balto *et al*., 2000) besides using histopathological findings (de Paula-Silva *et al*., 2009) or clinical sectioning (Blattner *et al*., 2010).

Conclusion

The clinician must have a thorough understanding of normal anatomy and of its variations. When root canal treatment is to be performed the clinician should be aware that both external and internal anatomy may be abnormal. Careful interpretation of angled radiographs, proper access preparation and a detailed exploration of the interior of the tooth are essential prerequisites for a successful treatment outcome. Within the limitations of this survey it can be concluded that students should be exposed to the various method of detecting root canals. They should be made aware of the importance of an accurate clinical evaluation of root canal number and morphology for a successful endodontic treatment.

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