

ROOT CANAL CONFIGURATION EVALUATION ON THE BASIS OF SECTIONING AND CLEARING TECHNIQUES

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ABSTRACT

Objectives:

Determination of Root canal configuration of maxillary first and second molar teeth was the aim of this study.

Study design: An in vitro experimental study.

Place and duration of the study:

Study was conducted in Gandhara University for a period of six month.

Materials and Methods:

Specimens were analyzed by sectioning and clearing techniques for evaluation of the pattern and configuration of roots. Dye penetration was the criteria which were then evaluated through microscope.

Results:

In clearing group, type-I canals are 18% more than sectioning group. While type-II was reversely i.e. 19% more in sectioning group than clearing group.

Conclusion:

Difference in both the study groups could be mainly due to failure of dye to pass through sclerosed or minute diameter secondary canal in clearing group. This study verifies that method of research has great influence on the results.

Key words: canal configuration, maxillary molars, mesiobuccal root, clearing technique,

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INTRODUCTION

In sixteenth century Vesalius, Fallopus and Eustachius described the pulpal anatomy. Peter Van Foreest in 1902 was the first to speak of root canal therapy. He suggested that the tooth be trephined and pulp chamber filled with theriak¹. Hollow tube theory² compelled the research workers in the field of endodontics to design special instruments for root canal preparation, to work on root canal filling materials and to formulate appropriate sealers to hermetically seal the canals. For successful endodontic treatment skill of the Operator and knowledge about the root canal morphology are two major requirements³. Ethnic variations may also influence and were considered in studies.⁴ Permanent maxillary molars usually have three separate roots, two buccal and one palatal.⁵

The palatal root is the strongest and the longest. It tapers towards the apex and is smoothly rounded. Disto-buccal root is the smallest, slender and smoothly rounded.⁶ Mesio-buccal root is usually not as long as lingual root but is broader bucco-lingually. It has broad, flat and often fluted effect⁷.

Root canal anatomy may present clinicians with a complex clinical challenge that requires diagnostic approaches, access modification, and clinical skills to successfully localize, negotiate, disinfect, and seal the root canal system. Hence, this study was performed to facilitate practitioners.

There are likely to be greater variations in the canal form in mesio-buccal root of maxillary permanent molars and the mesio buccal root canal often has supplementary branches⁵. This study evaluated the variations of roots found in first and second molars especially in maxillary.

MATERIALS AND METHODS

In this study a total of 225 extracted human maxillary molars (first and second) were fixed in 10% formalin immediately after extraction.. The teeth were randomly divided into two groups and the root canal configuration of mesio-buccal root was examined with the help of sectioning techniques and clearing technique.

In the clearing technique (modified from Seeling⁸) 125 teeth were placed in 5% HCL and the acid was changed daily until the teeth were decalcified. The decalcified teeth were washed in tap water for two hours to remove excess acid, and then the teeth and pulp tissue were made alkaline by placing them in a 10% solution of NaOH for 24 hours (seeling¹⁴ left the teeth in concentrated solution of NaOH for six hours). The teeth were washed in tap water for one hour to remove excess sodium hydroxide. Hematoxylin was injected with the help of a 27 gauge needle directly into pulp chamber through a hole in the dentin of crown and forced through the canals until the dye could be seen at the foramina. The excess dye covering the tooth was removed or decolorized by wiping the involved surface with a cloth soaked with 5% HCl. After cleaning the surfaces, the teeth were dehydrated in ascending concentrations of 70%, 95% and absolute alcohol. The teeth were then placed in xylene which made the teeth transparent after approximately two hours.

The cleared specimens were examined under a low power microscope to determine the root canal morphology of the mesio buccal root. The root canal configuration was classified into four classes as described by Weine⁹ due to its easy approach towards understanding and communication.

- TYPE I – Single canal from pulp chamber to apex.
- TYPE II – Two separate canals leaving the pulp chamber but merging short of apex.
- TYPE III – Two separate canals leaving the pulp chamber and existing as separate in the root ending in separate apical – foramina.
- TYPE IV – One canal leaving the pulp chamber but dividing short of the apex into two separate canals with separate apical foramina.

In the sectioning technique, one hundred extracted teeth were similarly stored in 10% formalin but decalcified in 5% solution of nitric acid.

The nitric acid was change daily and agitated manually at different intervals. The completion of decalcification was tested by probing the crown of the tooth with the help of sharp explorer. If the decalcification was incomplete, the teeth were further subjected to the action of 5% nitric acid. After completion of the decalcification the mesio buccal roots of the teeth were sectioned off with the help of thin fissure bur. The mesio buccal root was then embedded in a block of paraffin wax and a V- shaped notch was cut into the block for orientation purposes. With the help of microtome mesio distal cross cut sections were made of 0.5mm thickness. The sections numbering approximately 20 per root were arranged in sequence up on a glass slide for examination under a microscope.

RESULTS

CLEARING TECHNIQUE

Transparent maxillary molars were examined under dissection microscope for different canal configuration. The data was recorded. The summary of the data collected is in Table-1. 54.84% teeth are having only one canal in mesio-buccal root of maxillary molars and 45.17% are having two canals in different shape.

TableNo.1:

Total	Class-I	Class-II	Class-III	Class-IV
124.00	68.00	32.00	20.00	4.00
Percent	54.84	25.81	16.13	3.23

SECTION TECHNIQUE

Mesio-buccal roots of 100 maxillary molars were sectioned and studied with the help of dissecting micro scope for different canal configurations (Weine's classification). The data collected can be seen in Table-2.

Table.No.2:

Total	Class-I	Class-II	Class-III	Class-IV
100.00	37.00	45.00	16.00	2.00
Percent	37.00	45.00	16.00	2.00

These results are graphically depicted in figure-1 for clearing technique and figure-2 for sectioning technique. By comparing the results of the two groups it can be seen that there is big difference in the incidence of class-I and class-II canals in the two groups, which is graphically depicted in table No.3.

STATISTICAL ANALYSIS

The Chi-square Goodness-of-Fit test was performed and the results are shown in table-3. The sectioning technique has been used as standard technique. The results obtained in the type-I and type-2 are found statistically different.

Table No.3: Chi-Square Goodness-of-Fit Test

Type (Weine)	Observed Frequency (Clearance)	Expected Frequency (Sectioning)	Chi-Square
1	55	37.0	8.660177
2	26	45.00	8.18347
3	16	16.0	0.00106
4	3	2.0	075645

Chi-Square = 17.5427 with 3 d.f.

Sig. Level = 5.4645E-4

Fig.1: Clearing technique distribution

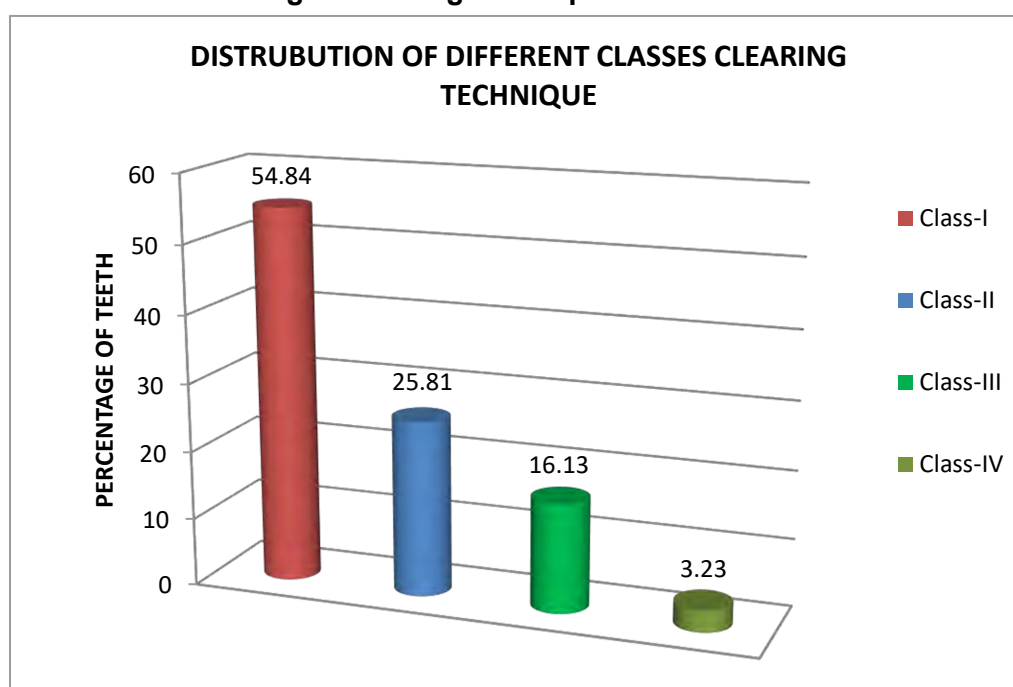
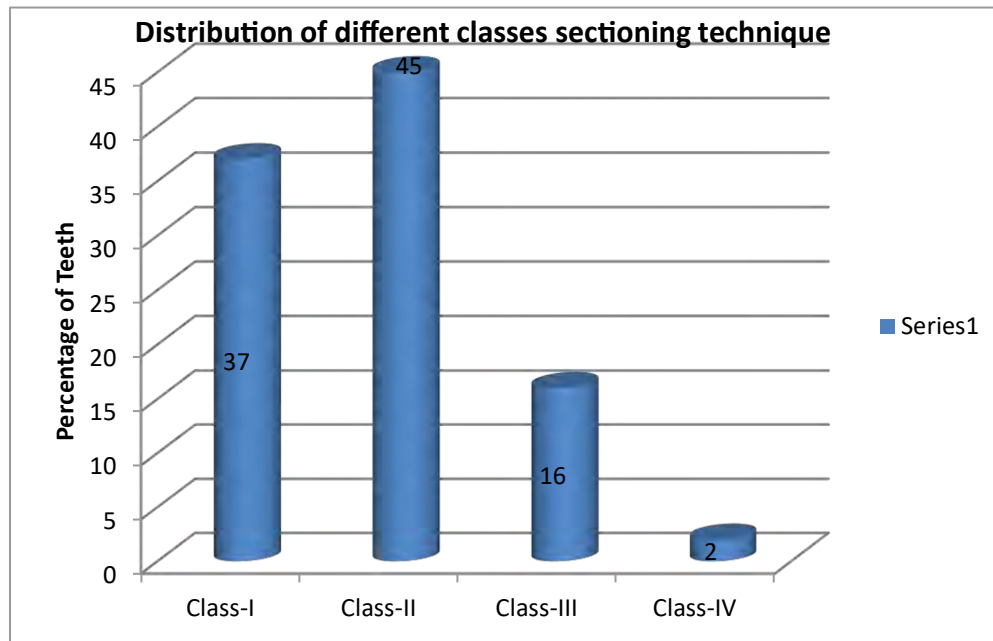
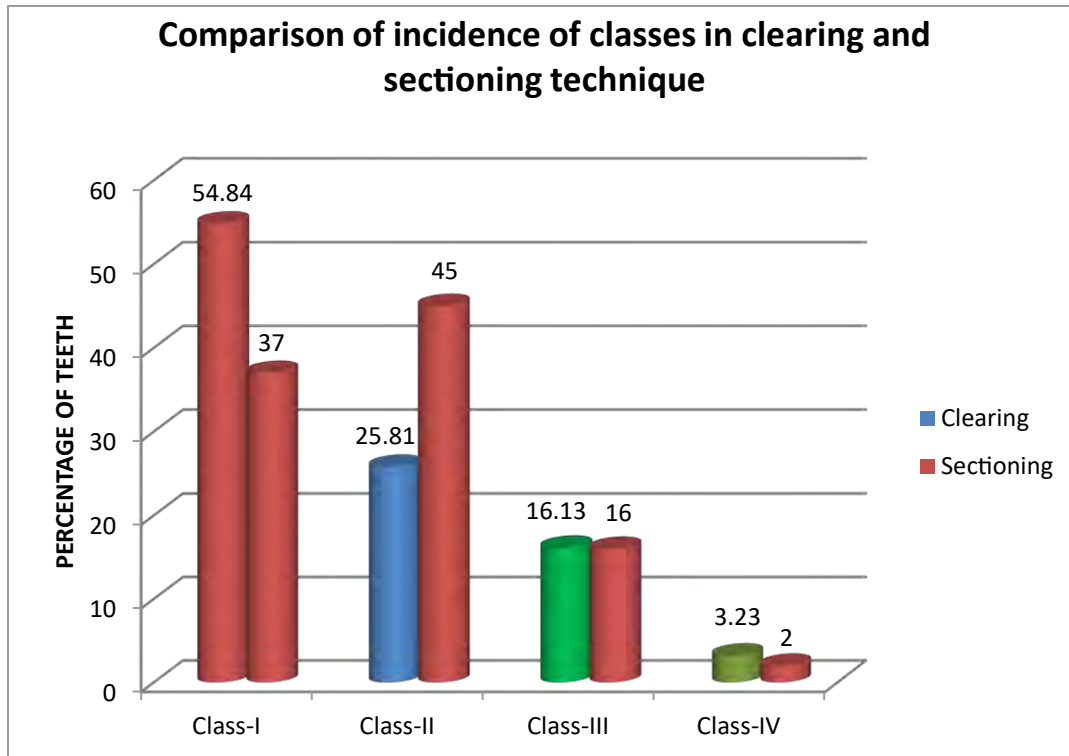


Fig.2: Sectioning technique distribution**Fig.3: Comparison of clearing and sectioning techniques**

DISCUSSION

A comparison of results obtained using two different techniques clearly indicates the difference in the incidence of two canals in the mesio-buccal root of maxillary molars.

As can be seen in figure-3 the incidence of two canals was higher in the sectioning group (63%), when compared to the clearing Group (45%). Since the samples for both the groups were derived from the same population, the difference in the results could be attributed to techniques used. It is very much possible that the clearing techniques, whose results are the due to enter into them, are less reliable than the sectioning technique.

The sectioning technique is not dependant on the patency of the canals and the root canal could be clearly visualized. In the literature it a few authors have alluded to the effects of technique on the results obtained. Green¹⁰ had attributed high percentage of two canals in the Pineda's study to the method used. According to him corridor shaped canals tend to appear as two separate canals on the radiograph. Our results obtained with the sectioning technique are one very close to obtained by Seidberg et al¹¹, Pineda¹² and to some extent with Weine¹⁵ but very different from Green¹⁶

Comparing our results to Seidberg et al¹⁷ who used horizontal sectioning technique on 100 maxillary first molars. In their study percentage of teeth having single canal in the mesio-buccal roots is 38% which is almost identical to 37%. Difference of results in other types of canals can mainly be attributed to the section size. In comparison to their 3mm thick cross cuts we used 0.5 mm thin sections. In ½mm sections reunion and division of the canals can be correctly judged, which usually take place in the apical third of the root.

Pineda¹⁸ who radiologically studied 254 maxillary first molars, used different classification which can partially be converted to Weine's¹² classification. 40.4% of his study specimens were type-I which is quite close to the results of our sectioning technique. Again there is disagreement in other types of canals, and the different method of research can be made responsible for it.

Our results obtained with clearing method are more close to one reported by Vertucci¹³ who used the same clearing technique. He studied each maxillary molar individually and if we pool his results for first and second maxillary molars, (the teeth on which we did the study).

Beside the above mentioned there are other good reasons for variation in the results.

1. **Age:** The effect of age on root canal system has been studied by a number of investigators Hess¹⁴, Barret¹⁵, Philippos¹⁶, Pineda and Kuttler¹⁷, Fitzwalter¹⁸, Thomas¹⁹ and is approved by most clinicians. The single dumb-bell shaped large canal of young individual change into two small rounded canals as the age advances.
2. **Sex:** Sexual dimorphism of teeth has been studied by Morrees²⁰, Gran²¹ et al, Rosenweig²², Ditch²³, and Rose, and recognized by many clinicians.
3. **Population:** difference in root canal anatomy may be due to the population from which the teeth were chosen. S.A. Manning²⁴.
4. **Reason for Extraction:** Reason of extraction is another cause of variations in results. In carious teeth small canals usually become sclerosed due to deposition of secondary dentine, while in periodontally involved or in healthy teeth these canals remain open.

CONCLUSION

Difference in both the study groups could be mainly due to failure of dye to pass through sclerosed or minute diameter secondary canal in clearing group.
So this study verifies that method of research has great influence on the results.

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