Type of Study *– Retrospective study*

Assessment of Working Length of Root Canal in Mandibular First Primary Molar in Children Aged between 2 to 6 Years

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Abstract

In the endodontic glossary the working length is defined as the distance from a coronal reference point to the point at which canal preparation and obturation should terminate. Pulpectomy is a process of complete removal of the necrotic pulp from the root canals of primary teeth and filling them with an inert resolvable material so as to maintain the tooth in the dental arch. A University based study was conducted on mandibular primary first molar. Various pathologies such as pain, swelling, abscess and resorption were considered. Data collection was done by reviewing the patient records and analysing the data of 501 patients from June 2019 to March 2020, then excel tabulation, Statistical analysis was done using SPSS and Pearson chi-square test was performed. The total number of patients seen were 501, age ranged from 2 to 6 years. Out of the total population 42.91% (215) were female and 57.09% (286) were males. The mean length of mesio buccal canal was 10.76 mm, mesio distal canal – 10.88 mm, and the distal canal was 11.2 mm in the mandibular first primary molar. Pulpal pathology with mean working length of the root canals were as follows, In pain the mesio buccal root had 10.76 mm, mesio lingual root had 10.81 mm and the distal root had 12.01 mm. Abscess the mesio buccal root had 10.75 mm, mesio lingual root 10.79 mm and the distal root 12.03 mm. Swelling the mesio buccal root had 10.75 mm, mesio lingual root had 10.80 mm, and the distal root had12 mm, Resorption mesio buccal root had 10.77 mm, mesio lingual root had 10.78 mm, and the distal root had 11.8 mm. In regard to various pathogens such as pain,swelling, abscess and resorption the working length was determined as 10.76 mm for mesio buccal root, 10.88 mm for mesio lingual root and 11.2 mm for distal root of the mandibular first primary molar.

Keywords*: Primary mandibular first molar, determination of working length*

Introduction

In the endodontic glossary the working length is defined as the distance from a coronal reference point to the point at which canal preparation and obturation should terminate [1]. Pulpectomy is a process of complete removal of the necrotic pulp from the root canals of primary teeth and filling them with an inert resolvable material so as to maintain the tooth in the dental arch [2]. The main objective of pulpectomy in the primary teeth is to retain the primary tooth as a fully functional component in the dental arch. The advantage of this process is that it provides integrity to the damaged tooth which provides spacing required for a new tooth to grow, and plays a role in self-esteem of the preschool children and also in speech development, function and esthetics [3,4].

Bacteria plays an important role in pulpal and periapical diseases. Dental caries is the most infectious disease in children. It is a complex process of demineralization and dissolution of the substance of the teeth leading to cavitation. Increase in malondialdehyde concentration in saliva can cause dental caries [5]. Tooth brushing is the primary method of maintaining good oral hygiene [6]. Fluoride when present in minimal quantity can prevent dental caries [7,8]. Dental neglect can lead to poor oral health, which increases the risk of dental caries in neglected children [9]. Frenal attachment can lead to accumulation of milk which can lead to dental caries [10].

The primary objective of cleaning and shaping is to remove the organic debris from the pulpal canal [11]. The conventional method of cleaning and shaping is done using hand files, which is a time consuming procedure which may cause a negative effect in the behaviour of the child, whereas with the use of rotary instruments the procedure time is reduced which increases the patient cooperation [12,13]. The different techniques that have been proposed for canal preparation include corono-apical and apico-coronal [14]. The clinical use of paediatric rotary Kedo-S files was effective during root canal preparation of primary teeth with reduction in instrumentation time [15]. These instruments debride the uneven walls and improve the quality of obturation [16,17]. Previously our team had conducted Systematic review [18] over the past 5 years. Now we are focusing on epidemiological surveys. The idea of this survey stemmed from the current interest in our community.

The process of determining accurate root canal length is a vital part for a successful root canal treatment in primary teeth in order to minimise the periapical injury and possible damage to erupting permanent teeth [19]. The accurate root canal length of primary teeth is difficult to predict because of the pattern of root resorption, physiological process or a pathological process due to periapical pathology. In the primary teeth the size, shape, and position of the root apices alter continuously, because of this it becomes difficult to accurately determine the root canal length of primary teeth [20,21]. Therefore, one of the main important things in the root canal treatment of primary teeth is to determine how far instruments should be advanced within the root canal and at what point the preparation and restoration should terminate [22,23].

There are various methods of determining the root canal length of a primary tooth are tactile sensation method (TSM), conventional radiography (X-ray), radiovisiography (RVG), and the electronic apex locator (EAL) method. Electronic apex locator methods give accurate root canal length when compared to other methods (24). Working length determination is an important factor for the success of root canal treatment, the canal should be prepared till the apical constriction or apical foramen [25]. The use of arbitrary Working length in anxious children is to reduce the duration of treatment for better cooperation from the child and to improve the quality of the treatment. Therefore the main objective is to determine the working length for Dravidian children aged 2 to 6 years.

The challenges faced are the negative attitude of the patients and parents due to fear of the treatment, difficulty in cleaning, shaping and obturation due to the tortuous canal anatomy of the teeth with resorbing and open apices [26,27].

Comparison of different methods of working length determination like digital radiography, conventional radiography and by using Electronic apex locator concluded that the accuracy in measuring working length in primary teeth was achieved by using electronic apex locator. With continuous advancements in the technology of EALs, the correct use of apex locators has a definitive place in clinical Pedodontics and their day to day use in clinics can reduce chairside time, limit radiation and achieve more cooperation from the children [28].

This research is very important for the success of pulpectomy and to avoid complications like perforation of the canal, overfilling or retained pulp tissue which may lead to failure of the treatment and cause reinfection .The aim of this study is to determine the working length of lower first primary molar in children aged between 2 to 6 years.

Materials and Methods

A University based study was conducted among 501 patients in mandibular first primary molar. Various pathologies such as pain, swelling, abscess and resorption were considered. Mandibular first primary molars that were indicated for pulpectomy were taken into consideration. The study was conducted with the approval of the Institutional Ethics Committee [SDC/SIHEC/2020/DIASDATA/0619-0320]. Two researchers namely DG and MR are involved in this study. Cross verification was done by two reviewers and the measures taken to minimize the sampling bias are by including all the data available with no sorting process.Inclusion criteria included the mandibular first primary molar in children aged between 2 to 6 years, the teeth that had demonstrated extensive caries, and teeth that showed the presence of two thirds of the root length radiographically. Bias was avoided by including all mandibular molar

teeth with pulpal pathologies. Stringent protocol in doing the working length determination using the conventional and digital radiography method was followed.

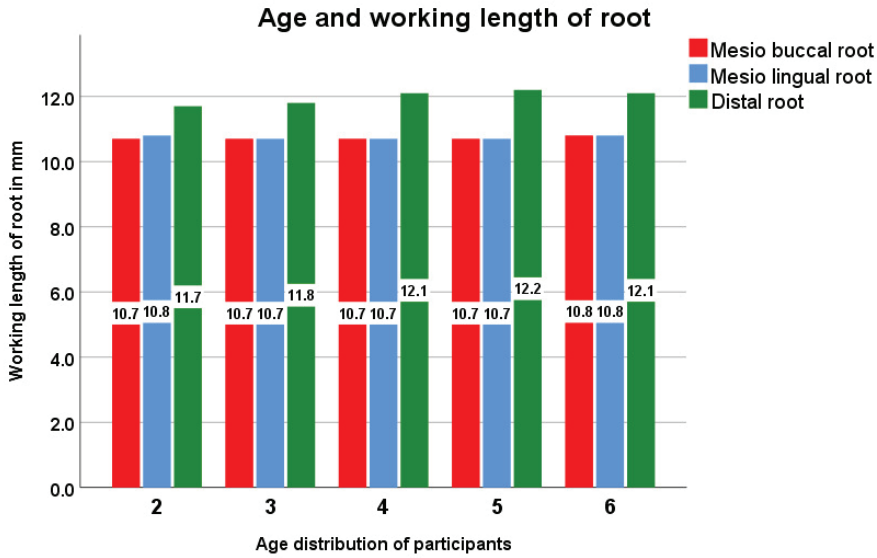
Data collection was done by reviewing the patient records and analysing the data of 501 patients from June 2019 to March 2020, excel tabulation of the data, statistical analysis was done using spss and pearson chi-square test was performed in the mandibular first primary molar in children aged between 2 to 6 years was done.

Incomplete or censored data was excluded from data. Statistical analysis was done by exporting the data to SPSS and Descriptive distribution of working length of mandibular first primary teeth was obtained.

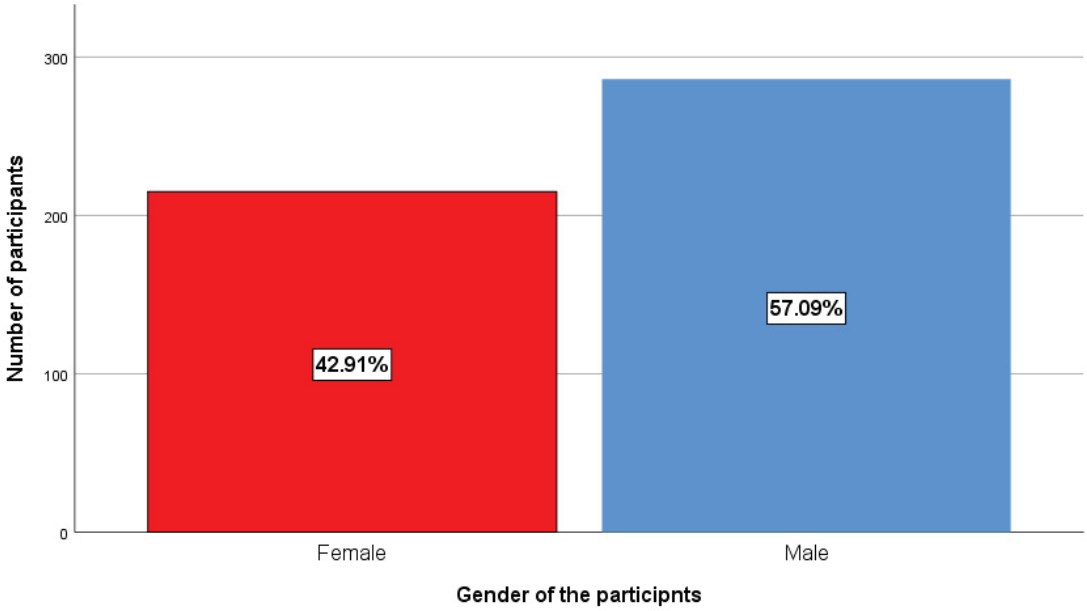
Results and Discussion

The total number of patients seen were 501, whose age ranged from 2 to 6 years (graph 1) with 4.46 years being the mean age. Out of the total sample 42.91 % (215) were female and 57.09% (286) were males (graph 2), there was no significant difference in the working length of mesio buccal, mesio lingual and distal roots between males and females as seen in graph 3.

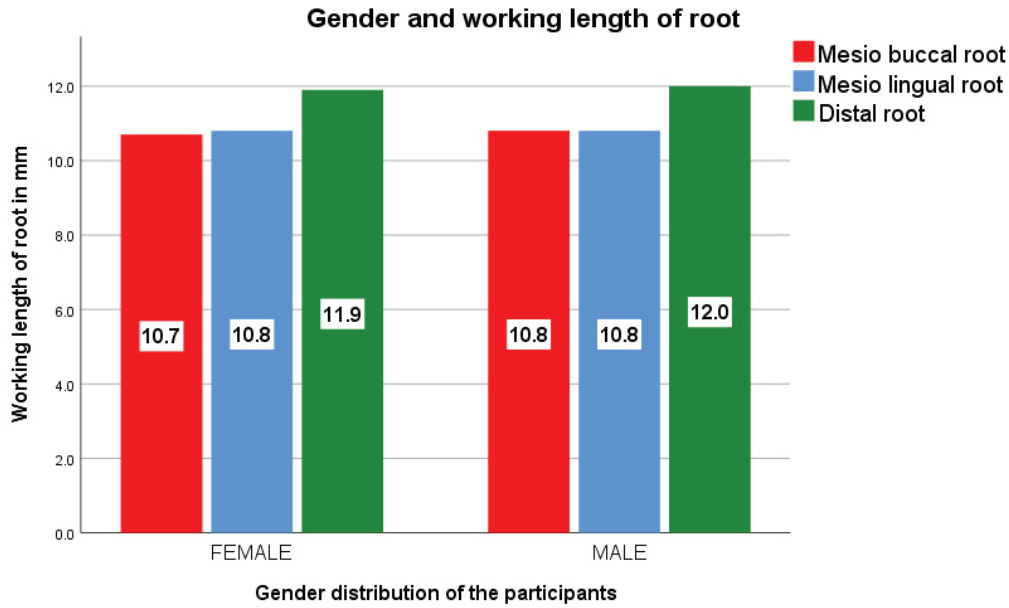
The four pulpal pathologies that were mainly treated in the mandibular first primary molar were pain, abscess, swelling, and resorption. Pulpal pathology with mean working length of the root canals were as follows, In pain the mesio buccal root had 10.76 mm, mesio lingual root had 10.81 mm and the distal root had 12.01 mm. Abscess the mesio buccal root had 10.75 mm, mesio lingual root 10.79 mm and the distal root 12.03 mm. Swelling the mesio buccal root had 10.75 mm, mesio lingual root had 10.80 mm, and the distal root had12 mm, Resorption mesio buccal root had 10.77 mm, mesio lingual root had 10.78 mm, and the distal root had 11.8 mm. Association of Mesio buccal canal with pulp pathology was done as shown in graph 4, Mesio lingual canal with pulp pathology was seen in Graph 5 and distal canal with pulpal pathology was seen in Graph 6.



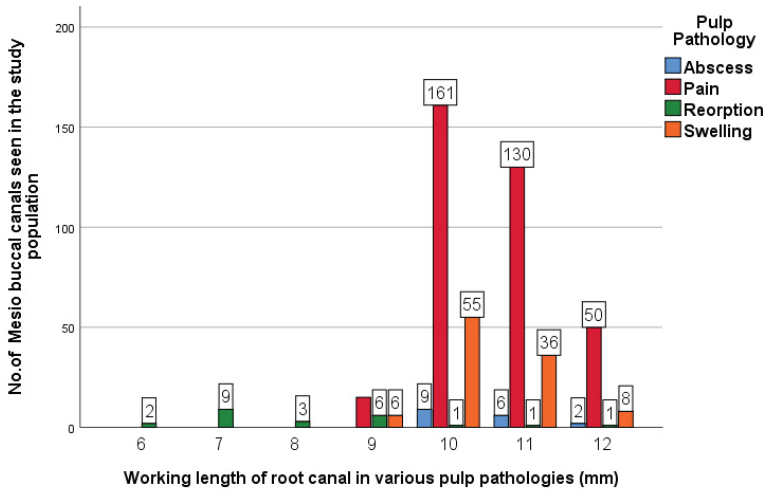
Graph 1 - This graph shows association between the age of participants and working length of root in mandibular first primary molar in children aged 2 to 6 years where red colour represents mesio buccal root with 10.8 mm in the age group 6, blue colour represents mesio lingual root with 10.8 mm in the age group 2 and 6 and green colour represents distal root with 12.2 mm in the age group 5. There was no mean difference between the working lengths in the age group of 2-6 years.The X axis represents the age of the participants and the Y axis represents the Working length of root in mm (mesio buccal, mesio lingual and distal root). Chi square test was done P = 0.998 for mesio buccal root (>0.05 - indicating statistically not significant), P = 0.847 for mesio lingual root (>0.05 - indicating statistically not significant) and P = 0.518 for distal root (>0.05 - indicating statistically not significant).



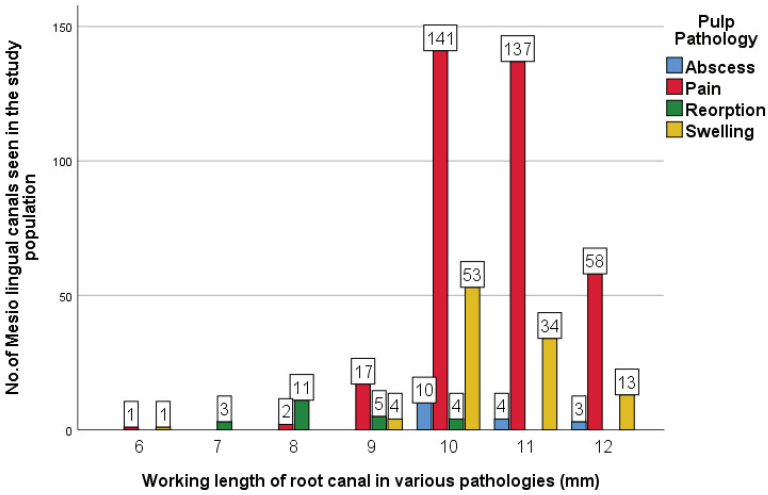
Graph 2 - Bar graph showing the descriptive distribution of gender of participants in mandibular first primary molar in children aged 2 to 6 years where red colour represents females with 42.91% and blue colour represents males with 57.09% The X axis represents the Gender of the participants and the Y axis represents the number of patients.



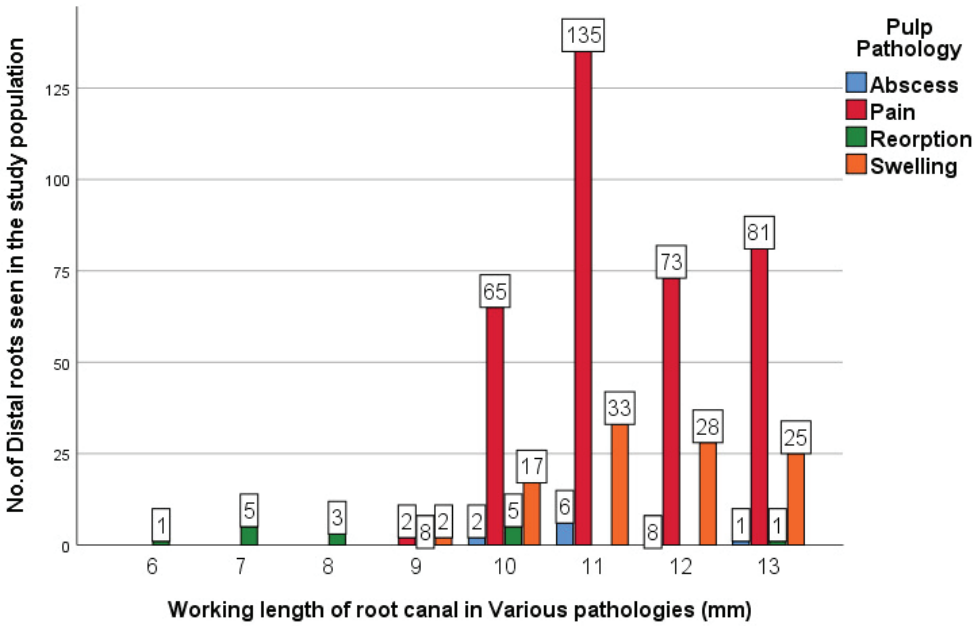
Graph 3 - This graph shows association between gender of participants and working length of root in mandibular first primary molar in children aged 2 to 6 years where red colour represents mesio buccal root, blue colour represents mesio lingual root and green colour represents distal root. There was no difference in the working length of mesio buccal, mesio lingual and distal roots between males and females. The X axis represents the gender distribution (Male and female) of the participants and the Y axis represents the working length of the root in mm (mesio buccal, mesio lingual and distal root). Pearson Chi square test was done, P = 0.00 for mesio buccal root (<0.05 - indicating statistically significant), P = 0.01 for mesio lingual root (<0.05 - indicating statistically significant) and P = 0.000 for distal root (<0.05 - indicating statistically significant).



Graph 4 - This graph shows association between pulp pathology (Abscess, Pain, Resorption and Swelling) of teeth considered for pulpectomy and working length of mesio buccal canal in mandibular first primary molar in children aged 2 to 6 years where blue colour represents Abscess, red colour represents pain, green colour represents resorption and yellow colour represents swelling. The X axis represents the working length of root canals in mm and the Y axis represents the number of Mesio buccal canals on a scale of 0-200 (count). The mean working length of root canal in mesio buccal canal is more when the patient has only abscess (10.97 mm) when compared with other pathologies such as Pain (10.87 mm), Swelling (10.75 mm) and Resorption (8.36 mm). Pearson chi-test was done P = 0.000 for mesio buccal root (<0.05 - indicating statistically significant).



Graph 5- This graph shows association between pulp pathology (Abscess, Pain, Resorption and Swelling) of teeth considered for pulpectomy and working length of mesio lingual canal in mandibular first primary molar in children aged 2 to 6 years where blue colour represents Abscess, red colour represents pain, green colour represents resorption and yellow colour represents swelling. The X axis represents the working length of root canals in mm and the Y axis represents the number of Mesio lingual canals on a scale of 0-200 (count). The mean working length of root canal in mesio buccal canal is more when the patient has Pain (10.94 mm) when compared with other pathologies such as Abscess (10.93 mm), Swelling (10.83 mm) and Resorption (8.53 mm). Pearson chi square test was done P = 0.000 for mesio lingual root (<0.05 - indicating statistically significant).P = 0.000 for distal root (<0.05 - indicating statistically significant).



Graph 6 - This graph shows association between pulp pathology (Abscess, Pain, Resorption and Swelling) of teeth considered for pulpectomy and working length of distal canal in mandibular first primary molar in children aged 2 to 6 years where blue colour represents Abscess, red colour represents pain, green colour represents resorption and yellow colour represents swelling. The X axis represents the working length of root canals in mm and the Y axis represents the number of Distal canals on a scale of 0-200 (count). The mean working length of root canal in mesio buccal canal is more when the patient has only Pain (12.275 mm) when compared with other pathologies such as Abscess (11.80 mm), Swelling (11.79 mm) and Resorption (8.79 mm). Pearson chi square test was done P = 0.000 for distal root (<0.05 - indicating statistically significant).

One of the most important goals in pediatric dentistry is to preserve the primary teeth until eruption of their succedaneous teeth in an attempt to prevent primary tooth loss sequels such as disturbance in mastication, speech, esthetics and correct tooth spacing .

According to this study the most common age group undergoing pulpectomy was observed to be 4 years and the age ranged from 2 to 6 years. Similarly in a study conducted by Yin-Lin, et al. he compared the working length of mandibular molars in the age group of 2-8 years,where the highest number of pulpectomies were done in the age group of 4 [29].

The mean working length was determined as 11.79 mm with apex locator and with digital radiography the length was observed as 11.98 mm, in this study it was observed that there was a decrease in the mean working length of resorption (8.56 mm), swelling (11.13 mm), and abscess (11.24 mm) and to avoid the radiographic error electronic apex locator should be used to determine the working length by Neena, I. E., et al. [30]. Literature is sparse in determining the working length of primary teeth. This study has an advantage of large sample size and of the same ethnicity, which will help in determination of working length .

Male patients had undergone more pulpectomy than female children. However there were no significant differences in the working length of the primary mandibular first molar based on gender [31].

In this study the mean working length of the distal root was longer than the mesial roots. The distal root showed the longest measurement (11.99 mm) followed by mesio lingual root (10.8 mm) and mesio buccal root (10.73 mm), which was in accordance with Reddy, N. Venugopal, et al [32]. where distal root showed maximum working length with a mean of 8.95 mm, whereas mesio

buccal root showed minimum length with a mean of 7.85 mm, but in contrast to the findings of Zoremchhingi et al [33] . This difference might be attributed to the different populations examined. Better knowledge of root length may be useful for determining the working length which prevents over or under instrumentation wherein debris removal might be hampered.

The pulp pathology was compared with the working length of the root in the mandibular first primary molar. Out of 501 children, 359 had pain, 105 had swelling, 23 had resorption, and 17 patients had abscess. The most commonly diagnosed pulp pathology in children was observed to be pain. During pain distal root was observed to have maximum working length of 12.28 mm, whereas mesio buccal root was found to have minimum working length of 10.87 mm.

The Limitations of the study were the radiographic shortcomings like angulation, distortion of image which were not included, Comparison should be done with other groups which included apex locators, CT and CBCT to measure the working length in mandibular first primary molar. The future scope is that all the parameters of root canal morphology and root angulations should be considered for the success of treatment in children and for a better scope of the study.

Conclusion

Within the limits of this study it is concluded that the mean working length was observed to be 10.76 mm for mesio buccal root, 10.88 mm for mesio lingual root, 11.2 mm for distal root. Pulpal pathology with mean working length of the root canals were as follows, teeth in which pain were present the mesio buccal root was 10.76 mm, mesio lingual root had 10.81 mm and the distal root had 12.01 mm in length respectively. In teeth with abscess the length of mesio buccal root was 10.75 mm, mesio lingual root was 10.79 mm and the distal root 12.03 mm. In case of swelling the mesio buccal root was 10.75 mm, mesio lingual root was 10.80 mm, and the distal root 12 mm.In case of resorption mesio buccal root was 10.77 mm, mesio lingual root was 10.78 mm, and the distal root was 11.8 mm.

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Conflict of Interest: There are no conflicts of interest as declared by the authors.

Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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