



## Working Length of Maxillary Primary First Molars in Children Aged 2-6 Years

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### ABSTRACT

An accurate and reproducible working length determination is a crucial aspect in pulpectomy. The cleaning, shaping and obturation cannot be adept precisely unless the working length is determined accurately. The determination of precise working length is one of the keys to accomplishment in endodontic therapy. Thus the aim of the study was to compare the working length of each root canal obtained for primary maxillary first molars in children aged 2-6 years. A retrospective study was carried out using digital records of 1,372 children who reported to the Department of Paediatric and Preventive Dentistry from June 2019 to March 2020. A total of 380 records were finally included for the study evaluation, which included maxillary primary first molars (54,64) Patients between the age group of 2-6 years were included in the study. The following data were retrieved from the dental records: age, gender, working length of each canal and pulpal pathology. The records were examined and noted in a spreadsheet. The collected data were analysed by computer software SPSS version 21 using one-way Anova test with the level of significance set at 5%. The mean age was observed to be 4.14 years in the present study. The mean working length was found to be 9.82mm (MB canal), 9.79mm (DB canal), 13.28mm (Palatal canal) with respect to pulpal pathology such as pain, swelling, abscess and resorption (P = 0.00). The reported data may help clinicians to obtain a thorough understanding of the working length of the primary maxillary first molars.

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### INTRODUCTION

The primary goal of pulpectomy in children is to preserve the tooth in the oral cavity until its physiological exfoliation to navigate the erupting permanent teeth (Govindaraju *et al.*, 2017a) and to preserve the teeth with irreversible pulp pathology in a symptom free state and preserve the integrity of the arch form (American Academy on Pediatric Dentistry Clinical Affairs Committee-, 2008) Bacteria plays a vital role in the commencement and perpetuation of pulpal and periapical disease (Jeevanandan, 2017; Jeevanandan and Govindaraju, 2018), However, a number of reasons, such as the complex anatomic morphology of the root canal system

in primary teeth, innate physiological root resorption, the close proximity of the permanent successor teeth and the difficulty of producing satisfactory radiological images of primary tooth apices makes it problematic to accomplish proper treatment (Carrotte, 2005). Conventionally, pulpectomy in deciduous teeth was executed using hand files, which is examined to be time consuming. With the use of rotary instruments, the procedural time has dwindled which in turn has increased the cooperation of the children (Govindaraju *et al.*, 2017b). The length of the appointment is greatly related with the child's behaviour (Govindaraju *et al.*, 2017c). An exact working length determination of root canal during endodontic treatment is essential. It makes endodontic treatment simpler for an operator to remove necrotic tissue and prepare canals accurately (Goldberg *et al.*, 2005) and to decrease periapical injury and damage to the succedaneous tooth bud. Numerous methods have been used to establish correct working length (Nair *et al.*, 2018; Panchal *et al.*, 2019). These include use of conventional or digital radiography (Stein and Corcoran, 1992), tactile method (Seidberg *et al.*, 1975) and moisture on paper point (Ruddle, 2001). A technique to be used in working length determination of root canals of primary teeth should give precise and reproducible results (Pratten and McDonald, 1996). Being relatively simple, many clinicians still practice tactile perception as an adequate means to disclose working length. However, it is mostly incorrect in root canals with constricted canals, excessive curvatures, and root resorption. The major hindrance in delivering apt dental care by the dentist during this situation and the dentist fear of any added risk to a permanent successor (Ravikumar *et al.*, 2017).

The conventional radiographic technique illustrated by Ingle has been one of the most favoured diagnostic tools for determining working length in endodontics. However, it is only able to contribute a two-dimensional (2D) image. The accuracy is difficult to be accomplished in this technique, because the presence of lateral canals/foramina or an apical constriction may not be analyzed. Especially in primary teeth, where even physiological root resorption is mostly oblique and not horizontal, one cannot rely on a 2D image. Furthermore, novel technological advances have turned digital radiography into a feasible option for the determination of endodontic working length. The reliability of digital radiography is seemingly comparable to or even better than that of conventional radiography (Versteeg *et al.*, 1997). Use of radiography to calculate root canal length may not always lead to exact results especially in case of physiological resorption of primary

teeth. Instrumentation and/or overfilling becomes much more possible if there is a mistake in the measurement technique. Thus the germ of a permanent tooth might get injured (Bahrololoomi *et al.*, 2015; Jerrell and Ronk, 1982). Moreover, poor cooperation of children makes it arduous to take a radiograph with acceptable diagnostic value (Pratten and McDonald, 1996; Oznurhan *et al.*, 2015).

There are only a small number of known studies on working length determination of maxillary first molars in deciduous teeth. To our knowledge, no previous studies have investigated the working length of each canal with respect to pulpal pathology. Therefore, the aim of the present study was focused on the working length determination with respect to pulpal pathosis in primary maxillary molar teeth in children aged 2-6 years (Ahmed, 2013).

## MATERIALS AND METHODS

### Study Design

This retrospective study was conducted in the Department of Pediatric and Preventive Dentistry and Department of Endodontics in a Dental College in Chennai. Data from 1,372 pulpectomy treated teeth were collected from dental records. Data were collected from June 2019 to March 2020. At data extraction, all information was anonymized and tabulated onto a spreadsheet. The study was commenced after approval from the Institutional Scientific Review Board, Saveetha Dental College and Hospitals.

To fulfil the inclusion criteria, patients between the age group of 2-6 years in teeth with extensive caries, presence of two-third of root length and evidence of pulpal pathology such as pain, swelling, abscess and resorption were considered for the present study. Teeth that are non-restorable were excluded from the study.

Out of 1,372 records that were retrieved, 992 records were excluded as they were records of other primary teeth that are not required for the study. A total of 380 records which consisted of primary maxillary first molars (54,64) were finally included for the study evaluation. The following data were retrieved from the dental records: age, gender, working length of each root canal and pulpal pathology. The records were examined and noted in a spreadsheet

### Statistical Analysis

The statistical analysis was done using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA). One-way Anova test was used to compare the working

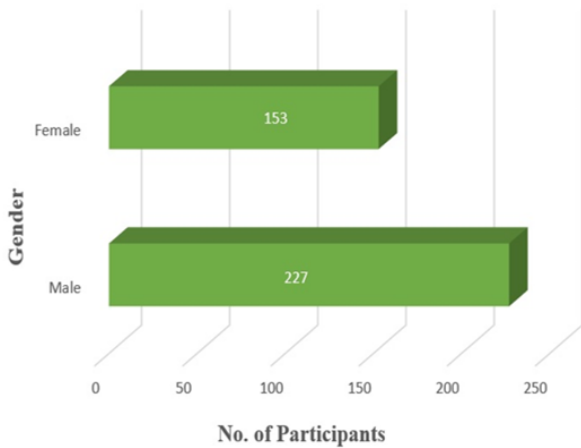
length between the three root canals. The significance level was set at 5% for the present study.

**RESULTS AND DISCUSSION**

**Table 1: Comparison of working length between the three canals (54,64)**

Working length (n=380)	Mean ± SD	Overall p-value
MB canal	9.81 ± 0.79	p=0.00
DB canal	9.79 ± 0.77	
PALATAL canal	13.28 ± 1.59	

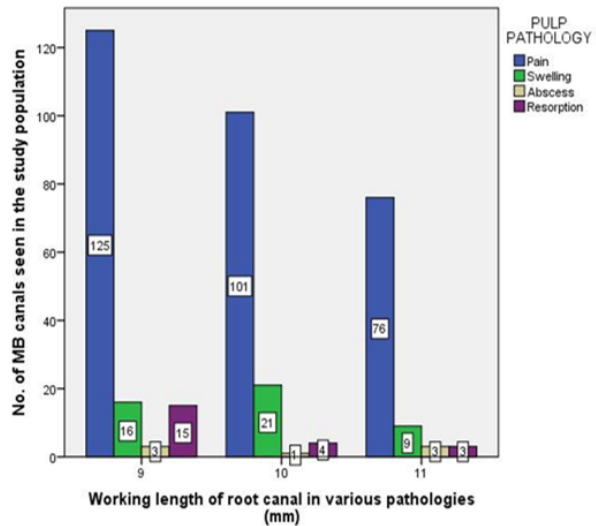
\*Oneway ANOVA test, p value obtained (p < 0.05)



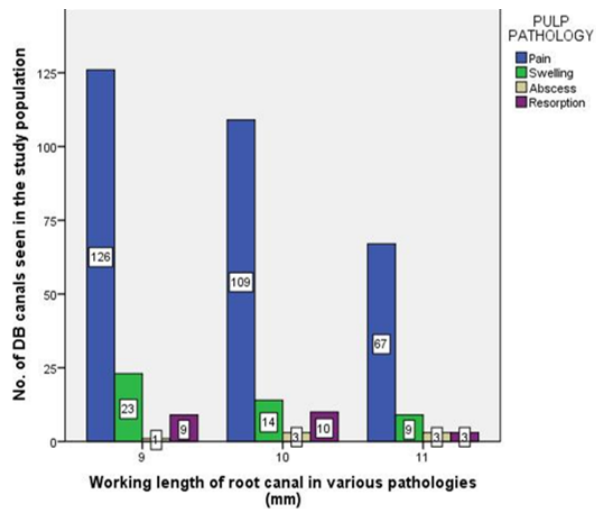
Graph 1: Bar chart showing the distribution of participants

In this study, out of 380 records, the mean age was observed to be 4.14 years. Gender showed an unequal distribution of participants in respect to the working length of each root canal [Graph 1] The mean working length was found to be 9.82mm (MB canal), 9.79mm (DB canal), 13.28mm (Palatal canal) with respect to pulpal pathology [Table 1, Graphs 2, 3 and 4] One way Anova test between the three root canals showed a statistically significant difference in the mean working length (P = 0.00) [Table 1].

Oral health plays a very crucial role in the general well-being of individuals, and parents' behaviour and attitudes influence the oral health of their children. It is the authority of parents to seek health-related requirements of their children. In this view, the absence of parent's or guardian's attention will have a negative impact on the child's oral status (Gurunathan and Shanmugaavel, 2016). Dental caries is a complex process that has been shown to



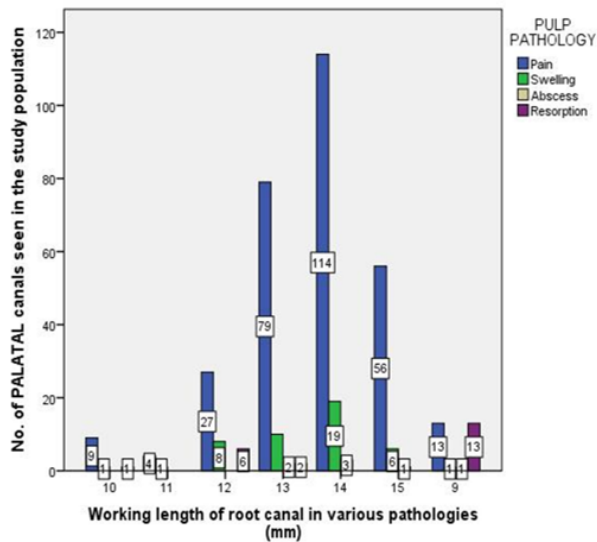
Graph 2: Bar chart showing distribution of MB canal length (54,64)



Graph 3: Bar chart showing distribution of DB canal length (54,64)

have a multifactorial etiology which leads to the initiation and progression of the lesion (Subramanyam et al., 2018). Fluoride is one of the direct ways in decreasing the prevalence of caries and its progression. It has been recommended for more than 50 years to prevent and control dental caries and it is a naturally occurring substance which is present in water (Ramakrishnan and Shukri, 2018; Somasundaram, 2015). Ranula is a cystic lesion that appears in the floor of the mouth. It can interfere with the endodontic management (Packiri et al., 2017). Hence it should be surgically removed to gain proper access.

In young children, the frenum is generally wide and thick, which becomes thin and small during growth. Thick frenum makes cleaning in that area difficult



Graph 4: Bar chart showing distribution of palatal canal length (54,64)

causing plaque accumulation which in turn may lead to caries in primary teeth (Christabel, 2015). Efficient plaque control is required for maintaining good gingival and periodontal health, prevention of dental caries and to protect the oral health (Claydon, 2008; Govindaraju, 2017). Working length determination in primary teeth poses a strategic challenge because the physiologic root resorption is mostly oblique and not always horizontal. This poses a serious need to determine the actual extent of the root canal space to be filled in by a resorbable obturating material. This was one of the major reasons to conduct this study using primary teeth. One of the most significant steps to get successful results in root canal treatment is to determine the length of the root canal accurately. Root resorption generally makes apex of root canals in primary teeth ambiguous. In the determination of length in a clinical setting, the only practice that is approved globally, accessible and trustworthy is radiography. However, repeated radiographic exposure of paediatric patients before, during, and immediately after the endodontic treatment may cause high concerns.

Nevertheless, radiography can give misleading results in resorption (Oznurhan et al., 2015). For the successful endodontic treatment of primary teeth, the root canal length should be determined exactly. Haluk et al. and Katz et al. performed a study to determine the working length in a dry and wet environment and found no significant difference in dry or wet canal condition (Bodur et al., 2008; Katz et al., 1996). Also a number of in vitro and in vivo comparative studies have performed to evaluate the accuracy of apex locators

with radiographic, tactile sense, visual method & digital radiographic method (Katz et al., 1996; Subramaniam et al., 2005). No significant difference was found between the methods compared.

According to Bagherian, A et al., MB root showed maximum root length, with a mean of 8.11mm and DB root showed the minimum length with a mean of 6.77mm. This study has compared the root length, whereas, working length in respect to each canal was not mentioned (Ghaemmaghami et al., 2008; Saritha et al., 2012).

In the present study, we found the mean working length to be 9.82mm (MB canal), 9.79mm (DB canal), 13.28mm (Palatal canal), whereas working length was not found. The present study has compared the mean working length of each canal with respect to pulp pathology, which is not found in the literature. The mean working length of the root canal with pathology was observed in case of pain (MB- 9.79mm, DB- 9.76mm, Palatal- 13.20mm), Swelling (MB- 9.76mm, DB- 9.69mm, Palatal-13.15mm), Abscess (MB- 9.63mm, DB- 9.54mm, Palatal- 10.63mm), Resorption (MB- 9.45mm, DB- 9.45mm, Palatal- 10.45mm). During pain, swelling, abscess and resorption, the palatal canal was observed to have maximum working length, whereas DB canal was found to have minimum working length. The existence of root resorption is an important characteristic of pulpectomy in primary teeth. It is hard to radiologically assess the small areas of resorption, especially if the resorption is on buccal/linguistic aspects of the root. To discard the disadvantages of radiographic assessment in these cases, electrical root length determination may be used. Electronic apex locators (EAL) can be used as alternatives to radiographs in working length determination during endodontic therapy as they are painless, easy and fast to operate, give good accurate results, and are able to detect artificial perforations (Neena et al., 2011). When radiograph is not available, the working length observed in the present study can be used as a reference in regard to various pathologies such as pain, swelling, abscess and resorption.

No comparison with other groups such as the tactile method, conventional radiograph, apex locators have been used in the present study. Only digital radiographs were used by the dentists for determining the working length of primary maxillary first molars. This is a potential source of bias. In the future, large sample size with all parameters such as root canal morphology, root angulation, root length should be studied in detail.

## CONCLUSION

The working length differs according to each pathology such as pain, swelling, abscess and resorption. The mean working length was found to be 9.82mm (MB canal), 9.79mm (DB canal), 13.28mm (Palatal canal) with respect to pulpal pathology in the present study. The reported data may help clinicians to obtain a thorough understanding of the working length of the primary maxillary first molars.

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The authors declare that they have no funding support for this study.

## Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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