

FURCATION ENTRANCE DIMENSIONS IN MALAYSIAN PERMANENT MOLARS AND ITS PERIODONTAL IMPLICATION IN ROOT PLANING

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Original Article

ABSTRACT

The objectives of this study were to measure the Furcation Entrance Dimensions of first and second permanent molars in Malaysian samples and to compare the Furcation Entrance Dimensions with the blade widths of periodontal Gracey's curette used for root surface instrumentation. A total of 199 extracted permanent teeth were measured, which comprised of 51 mandibular first molars, 51 mandibular second molars, 45 maxillary first molars and 52 maxillary second molars. Furcation Entrance Dimension was measured using calibrated test gauges. Results showed 51.91% of Furcation Entrance Dimension was ≤ 0.70 mm. Forty eight percent (48.09%) of Furcation Entrance had Furcation Dimension of more than 0.70mm. It was concluded that 51.91% of all the Furcation Entrance Dimensions of these teeth were less than the blade width of new Gracey currettes. Therefore, new periodontal Gracey's curette of small dimension may be the best choice of instrumentation and that ultrasonic debridement using a narrow tip may be a more appropriate choice.

Key words: Furcation entrance; molars; therapy; instruments

INTRODUCTION

Methods for the treatment of furcation involving molars have been shown to have variation degrees of success.¹ The goals of furcation areas therapy are the same as the goals in all of periodontal therapy: arresting the disease process and ultimately, maintaining the teeth in health and function with appropriate esthetics.^{2,3} Furcation areas present some of the greatest challenges to the success of periodontal therapy. It has been shown to reduce the efficacy of periodontal therapy that had been found in multirooted teeth with furcal involvement, regardless of the treatment modality employed.^{4,5} Molar root morphology influences the diagnosis, prognosis and treatment of periodontal disease.⁶ Numerous studies have documented a high loss of maxillary and mandibular molars because of

F.H. Al-Bayaty¹,
N.A. Baharuddin¹,
S.F. Hussain²

¹Department of Oral Medicine and Periodontology,
Faculty of Dentistry, University of Malaya
50603 Kuala Lumpur, Malaysia.

²Department of Orthodontics, Faculty of Dentistry,
Universiti Teknologi Mara

Corresponding author: Fouad Hussain Al-Bayaty

periodontal disease⁷. This is due, at least in part to difficulty in instrumenting the furcation areas. Effective instrumentation is considered more difficult to achieve when periodontal pockets are deeper and when the root furcations of multirooted teeth have become involved in periodontal pockets. The difficulties imposed by furcation involvement have been confirmed by studying root surfaces within the furcation regions of teeth extracted subsequent to instrumentation.^{8,9} It has been reported that various morphological characteristics of the first permanent molars may contribute to difficulties in cleaning surfaces within the furcation regions. Above all, Furcation Entrance Dimension was identified to be of prime importance.¹⁰ The purpose of this study was therefore to measure the Furcation Entrance Dimension in Malaysian first and second upper and lower permanent molars and to compare these dimensions with the blade of periodontal currettes which have been used in root debridement within furcation at the Faculty of Dentistry, University of Malaya.

MATERIALS AND METHODS

A total of 199 extracted teeth were retrieved, whereby 51 were mandibular first molars, 51 were mandibular second molars, 52 were maxillary first molars and 45 maxillary second molars. The extracted teeth were obtained following normal extraction from the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Malaya. All the teeth had intact furcation with unaltered tooth substance which could be due to dental caries, fractures or tooth wear. All the teeth were immersed in 5.25% sodium

hypochloride for 30 minutes and then rinsed in tap water to facilitate removal of any attached soft tissue. The hard tissues e.g. calculus was removed gently using ultrasonic scaler.

The protocol of Furcation Entrance Dimensions measurements was similar to that of Bower¹¹ with slight modification. In this study, a standardized set of metal test gauges with diameters of 0.30 – 3.0mm was used. A progressively larger test gauge was placed in the furcation entrances until the test gauge had a good fit between the roots. At the same time the test gauge should touch the most coronal part of the furcation entrance. Then, only the size of the test gauge is considered as the Furcation Entrance Dimension. At all time, a magnifying lens (5X) was used to provide good vision during the measurement.

Two examiners were involved in the measurement. Calibration exercise was carried out between inter-examiners and intra-examiners. The reproducibility was carried out by repeated measurements of 10% of the teeth examined. The reproducibility was accepted when the examiners showed a 91% reproducibility agreement. The blade face width of new and unused periodontal curettes no. 11, 12, 13 and 14 (Gracey-Ash instrument–Dentsply® UK) commonly used in periodontal therapy was measured 1 mm from the blade tip to determine the blade face width using a digital Vernier caliper (Mitutoyo-Digimatic® caliper-Mitutoyo Corporation). Similarly, the diameters of the tip as well as the diameter at 1mm and 2mm from the tip for a series of 7 new ultrasonic tips (Siemens® scaler) were measured using the same digital Vernier caliper. Tips was found to be sharply tapered, being 50mm at its tip and reaching a diameter 54mm from the point.

RESULTS

The results for Furcation Entrance Dimension of mandibular first and second molars according to the site of furcation entrance were shown in Table 1. The buccal furcation had the narrowest furcation

entrance i.e. less than 0.70mm (≤ 0.70 mm). The result also showed that 42.86% of buccal furcation for mandibular second molar and 41.18% of buccal furcation for mandibular first molar had an entrance dimension of ≤ 0.70 mm (Table 1). On the other hand, the lingual furcation entrance had the widest dimension, with 65.30% of the mandibular second molars and 58.82% of the mandibular first molars had entrance dimension of more than 0.70 mm (> 0.70 mm).

The Furcation Entrance Dimension of maxillary first and second molars was shown in Table 2. The buccal furcation had the narrowest furcation entrance dimension i.e. ≤ 0.70 mm. The results showed that 44.44% of the maxillary first molars and 71.15% of the maxillary second molars had Furcation Entrance Dimension of less and equal to 0.70mm (≤ 0.70 mm). On the other hand, the results showed that 95.56% of the mesial furcation and 91.11% of the distal furcation 91.11% of the first molars had Furcation Entrance Dimension of more than 0.70mm (> 0.7 mm). Similarly, 69.23% for mesial furcation, 65.49% for distal furcation of the second molars had Furcation Entrance Dimension of more than 0.70mm (> 0.7 mm). However, more than the half of the first molars' mesial and distal furcations had an entrance dimension of > 0.70 mm.

The widest furcation entrance dimensions i.e. of 1-3mm were found in 46.66% of the mesial furcation entrance and in 40.0% of the distal furcation entrance of the first molars. The distribution of maxillary and mandibular first and second permanent molars according to the Furcation Entrance Dimension on each tooth was shown in Table 3. It was shown that 75% of second maxillary molars, 44.44% of first maxillary molars, 44.9% of second mandibular molars and 41.18% of first mandibular molars had furcation entrance of less and equal of 0.07mm (≤ 0.70 mm). In general, Table 3 also demonstrated that 51.91% of the teeth (60.82% for maxillary, 43.0% for mandibular) had Furcation Entrance Dimension of 0.70mm or less, and 48.09% of the teeth (57% of mandibular, 39.18% of maxillary) have Furcations Entrance Dimension

Table 1. Entrance dimension (X) mm of mandibular first and second permanent molars furcation according to site

| Furcation Entrance Size (X) mm | Mandibular First Molars | | Mandibular Second Molars | |
|--------------------------------|--------------------------------|-------------------------------|--------------------------------|-------------------------------|
| | Lingual Furcation entrance (%) | Buccal Furcation entrance (%) | Lingual Furcation entrance (%) | Buccal Furcation entrance (%) |
| 0.30 \leq x \leq 0.50 | 11.77 | 11.77 | 22.45 | 18.37 |
| 0.50 < x \leq 0.70 | 29.41 | 29.41 | 12.25 | 24.49 |
| 0.70 < x \leq 0.90 | 35.29 | 35.29 | 32.65 | 22.45 |
| 0.90 < x \leq 1.0 | 15.69 | 13.73 | 8.16 | 14.29 |
| 1.0 < x \leq 2.0 | 7.84 | 9.8 | 24.49 | 20.4 |
| 2.0 < x \leq 3.0 | 0 | 0 | 0 | 0 |

Table 2. Entrance dimension (X) mm of maxillary first and second permanent molars furcation according to site.

| Furcation Entrance Size (X) mm | Maxillary First Molars | | | Maxillary Second Molars | | |
|--------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| | Mesial Furcation entrance (%) | Distal Furcation entrance (%) | Buccal Furcation entrance (%) | Mesial Furcation entrance (%) | Distal Furcation entrance (%) | Buccal Furcation entrance (%) |
| 0.30 ≤ x ≤ 0.50 | 0 | 0 | 22.22 | 1.92 | 7.69 | 50 |
| 0.50 < x ≤ 0.70 | 4.44 | 8.89 | 22.22 | 28.85 | 26.92 | 21.15 |
| 0.70 < x ≤ 0.90 | 35.56 | 28.89 | 35.56 | 21.15 | 15.39 | 28.85 |
| 0.90 < x ≤ 1.0 | 13.33 | 22.22 | 17.78 | 25 | 19.23 | 0 |
| 1.0 < x ≤ 2.0 | 44.44 | 37.78 | 2.22 | 19.23 | 26.92 | 0 |
| 2.0 < x ≤ 3.0 | 2.22 | 2.22 | 0 | 3.85 | 3.85 | 0 |

Table 3. Distribution of all mandibular, all maxillary mandibular, maxillary first and second permanent molars according to Minimum Furcation Entrance dimension (X) mm

| Furcation Entrance Size (X) mm | All Maxillary Molars % | Maxillary Molars % | | All Mandibular Molars % | Mandibular Molars % | |
|--------------------------------|------------------------|--------------------|--------|-------------------------|---------------------|--------|
| | | First | Second | | First | Second |
| 0.30 ≤ x ≤ 0.50 | 38.14 | 22.22 | 51.92 | 18 | 13.73 | 22.45 |
| 0.50 < x ≤ 0.70 | 22.68 | 22.22 | 23.08 | 25 | 27.45 | 22.45 |
| 0.70 < x ≤ 0.90 | 30.93 | 37.78 | 25 | 33 | 37.25 | 28.57 |
| 0.90 < x ≤ 1.0 | 7.22 | 15.56 | 0 | 8 | 9.8 | 6.12 |
| 1.0 < x ≤ 2.0 | 1.03 | 2.22 | 0 | 16 | 11.76 | 20.41 |
| 2.0 < x ≤ 3.0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4. Blade face width of Gracey periodontal curettes and diameter of ultrasonic scaler tip

| Type of instrument | Blade Width (mm) |
|---|------------------|
| Curette/Gracey-Ash instrument-dentsply UK | |
| 11 | 0.77 |
| 12 | 0.80 |
| 13 | 0.70 |
| 14 | 0.78 |
| Ultrasonic scaler tip Siemens scaler | 0.52 |

of more than 0.70mm. Table 4 showed the mean of seven blade face widths of periodontal Gracey curettes and diameter of Siemens scaler tip, at 1mm from end.

DISCUSSION

The method used in this study is similar to Bower¹¹ and Chiu.¹² The modification adapted by the author is similar to those previous authors i.e. by using a test gauge with a range of 0.3mm to 3mm. The modification was necessary, due to the need to

measure the furcation entrance at its most coronal parts. The measurement method used in this study is crude and therefore it is suggested that photogrammetric technique which is commonly used in root surfaces topography could have improved the accuracy of dimension measurement¹³.

The author found that 41.18% of the teeth had narrow (≤0.70mm) furcation entrance in Malaysian mandibular first molars. The finding is consistent to study by Bower¹¹ on Mongoloid population whereby found 58% of the teeth had narrow (≤0.70mm) furcation entrance. Another study by Chiu¹² also found similar finding on Chinese population whereby 49% of the teeth had narrow (≤0.70mm) furcation entrance.

This present study showed a higher frequency of narrow buccal furcations entrances in maxillary first molars than in mandibular first molars. These findings were in agreement with that found by Bower¹¹ and Chiu¹² where 41.11% of narrow (≤0.70mm) furcation entrances in mandibular first molars were found. However, Bower¹¹ and Chiu¹² found a proportion of narrow (≤0.75mm) furcation entrance i.e. 63% and 36% respectively in Mongoloid and Chinese mandibular first molars. This present study also found that for maxillary first and second molars, the mesial furcation entrance dimensions

were the widest followed by the distal and buccal furcations. These results were in agreement with that found by Hou et al.¹⁴.

Information with respect to furcation entrance dimension in second molars has only been published by Hou et al.¹⁴ The present study observed that 75% and 44.90% of all furcations in maxillary and mandibular second molars respectively were narrower than 0.75mm, which was the narrowest blade of new periodontal Gracey® curettes. Again these findings were in agreement with that found by Hou et al, when comparing the distribution of furcation entrance dimensions as reported by Bower¹¹, Chiu et al.¹² and Hou et al.¹⁴ with the present findings. It was evident that the present study observed a large percentage of furcation entrance dimensions exceeding 0.70mm and 1.0mm to 2.0mm and 3.0mm diameters compared to other investigators. This discrepancy may be explained by factors such as genetic differences in the sample population as well as differences in the methodology.

Hou et al¹⁴ concluded that the majority of molars are at high risk for continuous periodontal breakdown. This is because access in most furcations is difficult to achieve for standard scaling and root planing instrument. Therefore, it is likely that narrow furcation entrances diameter carries a poorer prognostic indication as complete instrumentation by the current curettes is difficult to achieve. To achieve biologically acceptable root surfaces within the furcations areas of Malaysian molars, the results of this study indicate new periodontal curettes of smaller dimension may be the best choice of instrumentation than the current one and that ultrasonic debridement using a narrow tip may be a more appropriate choice.

CONCLUSION

In 51.91% of furcation entrances the diameter was less than the width of the commonly used curettes which means that such instruments are unlikely to clean the furcation area in clinical situation.

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