

Morphological and Pulp Space Configuration
Variations in Maxillary First Molar among
Egyptian and Kuwaiti Populations
(An invitro study)

A thesis

Submitted to the Endodontic Department, Faculty of Oral and Dental
Medicine, Cairo University

For partial fulfillment of the requirements of the
Master Degree in dental surgery (Endodontics).

By

Khalida Mohamed Saleh Al-Hashemy

BDS (1996) Cairo University

Faculty of Oral and Dental Medicine

Cairo University

2010

Supervisors

Prof. D R. Medhat A. Kataia

Professor of Endodontics

Head of Endodontic Department

Faculty of Oral and Dental Medicine

Cairo University

D R. Samia M. El Sheref

Lecturer of Endodontics

Faculty of Oral and Dental Medicine

Cairo University

بسم الله الرحمن الرحيم

((وعلمك ما لم تكن تعلم وكان فضل الله عليك عظيماً))

صدق الله العظيم

سورة النساء الآية ١١٣

Dedication

*To my big family; my father, my mother and brothers
and to my small family; my husband and my kids.*

Acknowledgements

First of all, I thank Allah for paving the way to fulfill this work. I would like to express my sincere gratitude and appreciation to Dr. Medhat Kataia, professor of Endodontics, Faculty of Oral and Dental Medicine, Cairo University. I will remain grateful to him for his advice, scientific supervision and kind guidance throughout the entire course of this work.

I am also grateful to Dr. Samia El Sheref, lecturer of Endodontics, Faculty of Oral and Dental Medicine, Cairo University, for her unlimited effort and time spent in teaching, advising and encouraging me throughout this work.

Finally many thanks to the members of Endodontic Department, Faculty of Oral and Dental Medicine, Cairo University, for their kind cooperation during this work.

Contents

Subject	Page
List of tables	i
List of figures	ii
Introduction	1
Review of literature	3
Aim of the study	33
Materials and methods	34
Results	42
Discussion	78
Summary and Conclusion	83
References	88
Arabic Summary	

List of Tables

No		Page
Table (1)	Number and percentage of maxillary first molars with 3 or 4 canal orifices per tooth.	49
Table (2)	Number and percentage of canal orifices.	50
Table (3)	Mean and standard deviation (SD) values of the diameter of MB1 & MB2, the distance between MB1 & MB2 and angle formed by the intersection of MB1-MB2 line and MB1 palatal line.	51
Table (4)	Number and percentage of maxillary first molars with 3, 4 or 5 canals per tooth.	58
Table (5)	Number and percentage of canal system types in the maxillary first molars of both groups.	59

No		Page
Table (6)	Number and percentage of canals, lateral canals and apical deltas.	62
Table (7)	Incidence of the MB roots with single or double canals.	66
Table (8)	Frequency of one or two curvatures in MB roots with single canal.	67
Table (9)	Frequency of one or two curvatures in MB roots with double canals.	68
Table (10)	Degree of curvatures of the MB root canals.	67
Table (11)	Distance from the buccal cusp tip to the roof of the pulp chamber & the height of the pulp chamber.	76

List of figures

Fig. No		Page
Figure (1)	A photograph showing the dental operating microscope.	38
Figure (2)	A photograph showing the stereomicroscope.	38
Figure (3)	Angle of curvature (α) as determined by lines <i>a</i> and <i>b</i> .	41
Figure (4)	A photograph showing three canal orifices (Egyptian group).	46
Figure (5)	A photograph showing three canal orifices (Kuwaiti group).	46
Figure (6)	A photograph showing the diameter of the canal orifices (Egyptian group).	47
Figure (7)	A photograph showing the distances between MB1&MB2 of the canal orifices & the angle formed by the intersection of MB1- MB2 line and MB1- palatal line (Egyptian group).	47
Figure (8)	A photograph showing the diameter of the canal orifices (Egyptian group).	48
Figure (9)	A photograph showing the distance between MB1&MB2 of the canal orifices & the angle formed by the intersection of MB1- MB2 line and MB1- palatal line (Egyptian group).	48
Figure (10)	A photograph showing the diameter of the canal orifices (Kuwaiti group).	49
Figure (11)	A photograph showing the distance between MB1&MB2 of the canal orifices & the angle formed by the intersection of MB1- MB2 line and MB1- palatal line (Kuwaiti group).	49

Fig. No		Page
Figure (12)	A photograph showing the diameter of the canal orifices (Kuwaiti group).	50
Figure (13)	A photograph showing the distance between MB1&MB2 of the canal orifices & the angle formed by the intersection of MB1- MB2 line and MB1- palatal line (Kuwaiti group).	50
Figure (14)	A bar chart showing the percentage of the maxillary first molars with 3 or 4 canal orifices per tooth in both groups.	51
Figure (15)	A bar chart showing the percentage of the 2nd canal orifices in both groups.	52
Figure (16)	A bar chart showing the mean and standard deviation (SD) values of the diameter of MB1& MB2 and the distance between MB1&MB2 in both groups.	54
Figure (17)	A bar chart showing the mean and standard deviation (SD) values of the angle formed by the intersection of MB1-MB2 line and MB1- palatal line in both groups.	54
Figure (18)	A photograph showing type I canal configuration (Egyptian group).	57
Figure (19)	A photograph showing type II canal configuration of the MB root (Egyptian group).	57
Figure (20)	A photograph showing type II canal configuration of the DB root (Kuwaiti group).	58
Figure (21)	A photograph showing type I canal configuration with lateral canals (Egyptian group).	58
Figure (22)	A photograph showing type IV canal configuration in the MB root with apical deltas (Kuwaiti group).	59

Fig. No		Page
Figure (23)	A bar chart showing the percentage of the maxillary first molars with 3, 4 or 5 canal orifices per tooth in both groups.	60
Figure (24)	A bar chart showing the percentage of the canal system types in the maxillary first molars in both groups.	61
Figure (25)	A bar chart showing the percentage of the 2 nd canals, lateral canals and apical deltas in both groups.	62
Figure (26)	A periapical radiograph showing a single MB canal with one curvature (Egyptian).	65
Figure (27)	A periapical radiograph showing one curvature in the MB1 and two curvatures in the MB2 (Egyptian).	65
Figure (28)	A periapical radiograph showing one curvature in the MB1 and one curvature in the MB2 (Egyptian).	66
Figure (29)	A periapical radiograph showing one curvature in the MB1 and two curvatures in the MB2 (Kuwaiti).	66
Figure (30)	A periapical radiograph showing two curvature in the MB1 and two curvatures in the MB2 (Kuwaiti).	67
Figure (31)	A bar chart showing the percentage of the MB roots with single or double canals in both groups.	68
Figure (32)	A bar chart showing the percentage one or two curvatures in MB roots with single canal in both groups.	69
Figure (33)	A bar chart showing the percentage one or two curvatures in MB roots with double canals in both groups.	70
Figure (34)	A bar chart showing the degree of curvatures of the MB root canals in both groups.	71

Fig. No		Page
Figure (35)	A periapical radiograph of a case no.1(Egyptian).	73
Figure (36)	A periapical radiograph of a case no.2 (Egyptian).	73
Figure (37)	A periapical radiograph of a case no.3 (Egyptian).	74
Figure (38)	A periapical radiograph of a case no.4 (Egyptian).	74
Figure (39)	A periapical radiograph of a case no.5 (Egyptian).	75
Figure (40)	A periapical radiograph of a case no.1 (Kuwaiti).	75
Figure (41)	A periapical radiograph of a case no.2 (Kuwaiti).	76
Figure (42)	A periapical radiograph of a case no.3 (Kuwaiti).	76
Figure (43)	A periapical radiograph of a case no.4 (Kuwaiti).	77
Figure (44)	A periapical radiograph of a case no.5 (Kuwaiti).	77
Figure (45)	A bar chart showing the distance from the buccal cusp tip to the roof of the pulp chamber & the height of the pulp chamber in both groups.	78

List of abbreviations

MB	:	Mesiobuccal
DB	:	Distobuccal
P	:	Palatal
DOM	:	Dental Operating Microscope
mm	:	millimeter
cm	:	centimeter
&	:	and

Introduction

The variation of pulp cavity morphology especially in multi-rooted teeth is a constant challenge for diagnosis and successful endodontic therapy. Knowledge of the most common anatomic characteristics and their possible variations is fundamental, because the missing of one canal can lead to endodontic failure.

Moreover, incomplete obturation of the root canal leaves residual space for microbial colonization and proliferation and may also imply that cleaning was incomplete. Therefore, the correct location, cleaning, shaping and obturation of all canals are indispensable procedures.

The anatomical complexities of root canal anatomy have been highlighted in the literature. The clinician should be aware of the possibility of the existence of fewer numbers of roots or canals than the normal root canal anatomy. Variations in canal morphology such as extra canals, apical ramifications, apical deltas, or lateral canals are commonly encountered and their incidence and significance have been well documented.

However, root anatomy studies were divided into laboratory studies (in vitro), clinical root canal system anatomy studies (in vivo) and clinical case reports of anomalies.

There are a wide variety of methods used in these studies. These methods in the laboratory include various types of clearing studies using decalcification using injection with India ink, Chinese ink, hematoxylin dye, plastic, or metal castings, in vitro endodontic access with different radiographic methods (conventional, digital and cone beam computed tomography), radiopaque gel infusion and radiography, in vitro root canal treatment, macroscopic examination, scanning electron microscope examination of pulp floor and grinding or sectioning.

The clinical methods include clinical evaluation during endodontic treatment with or without magnification, retrospective evaluation of patient records of RCT and in vivo radiographic examination.

Therefore, this study was carried out to to compare variations in roots, root canals and pulp space configuration of the maxillary first molar of the Egyptian and Kuwaiti populations.