بسم الله الرحمن الرحيم

" وعلمك ما لم تكن تعلم وكان فضل الله عليك عظيماً"

صدق الله العظيم

سورة النساء الاية ١١٣

Assessment of Relationship between the Mandibular Canal and Impacted Third Molar by Cone Beam Computed Tomography versus Panoramic Radiography

A thesis

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

In

Partial Fulfillment of the requirements of the Master Degree in Oral Surgery

By

Mostafa Mahmoud Azab

BDS (2004), Cairo University

Faculty of Oral and Dental Medicine
Cairo University

2013

Supervisors

Dr. Mohammed Galal Beheiri

Professor of Oral and Maxillofacial Surgery
Faculty of Oral and Dental Medicine
Cairo University

Dr. Dalia Abd-El khalek Radwan

Assistant professor of Oral and Maxillofacial Surgery
Faculty of Oral and Dental Medicine
Cairo University

Dr. Noha Saleh M.Abu-Taleb

Lecturer of Oral Radiology
Faculty of Oral and Dental Medicine
Cairo University



To my family; my father, my mother and my sisters

To my supervisors who helped me to succeed and supported me during my study

To my future wife who supports me in every step throughout our life.

<u>Acknowledgments</u>

First and foremost to ALLAH, goes all my deepest gratitude and thanks for achieving any work in my life.

This thesis would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this work.

I find that words are simply inadequate, they merely represent only a symbol of my deepest gratitude and appreciation to my great professor, **Dr. Galal Beheiri,** Professor of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University. His mastery in teaching, generous help, support, kindness and humanity, not only in this work, but also in all aspects of the field of oral and Maxillofacial surgery will never cease to amaze me.

It gives me great pleasure to express my deepest thanks and profound respect to **Dr. Dalia Abd-Elkhalek Radwan**, Assistant Professor of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University, for her meticulous scientific supervision during every step of this work.

I would also like to pay tribute to **Dr. Noha Saleh Abu-Taleb**, Lecturer of Oral Radiology, Faculty of Oral and Dental Medicine, Cairo University, for her scientific cooperation, great support and encouragement.

Last but not least I would like to express my gratitude to Dr. Sameh Mekhemer, Professor of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University, and Dr. Ahmed Barakat, Professor of Oral and Maxillofacial Surgery, Faculty of Oral and Dental Medicine, Cairo University, for being outstanding advisors and for their constant encouragement, support, and invaluable suggestions throughout my life.

Contents

Subject	Page
List of tables	
List of figures	
List of abbreviations	
Introduction	1
Review of literature	3
Aim of the study	37
Patients and methods	38
Results	55
Case presentation	85
Discussion	91
Summary and Conclusion	105
Recommendationss	108
References	109
Appendix 1	127
Appendix 2	128

List of Tables

Table		Page
1	Frequencies (n) and percentages (%) of different signs of approximation between IAC and mandibular third molar.	55
2	Frequencies (n) and percentages (%) of different relationships of the mandibular third molar to the IAC.	58
3	Frequencies (n) and percentages (%) of different angulations of impacted mandibular third molar.	60
4	Frequencies (n) and percentages (%) of different positions of the IAC in relation to the impacted mandibular third molar.	62
5	Frequencies (n) and percentages (%) of presence of contact between the IAC and the impacted mandibular third molar.	64
6	Frequencies (n) and percentages (%) of different relations between the cortical plate and the impacted mandibular third molar.	66
7	Frequencies (n) and percentages (%) of different clinical findings.	69
8	Frequencies (n), percentages (%) results of chi-square test for the association between tooth position and different panoramic findings.	70
9	Frequencies (n), percentages (%) results of chi-square test for the association between angulation and different panoramic findings.	71
10	Frequencies (n), percentages (%) results of chi-square test for the association between IAC position and cortical plate relation to the impacted third molar.	72
11	Frequencies (n), percentages (%) results of chi-square test for the association between IAC position and panoramic findings.	73
12	Frequencies (n), percentages (%) results of chi-square test for the association between contact between IAC and tooth with panoramic findings.	74
13	Frequencies (n), percentages (%) results of chi-square test for the association between buccal cortical plate relations and panoramic findings.	75

Table		Page
14	Frequencies (n), percentages (%) results of chi-square test for the association between lingual cortical plate relations and panoramic findings.	76
15	Frequencies (n), percentages (%) results of chi-square test for the association between clinical and panoramic findings.	77
16	Frequencies (n), percentages (%) results of chi-square test for the association between clinical and CBCT findings.	78
17	Sensitivity, specificity and diagnostic accuracy of panorama in detecting darkening of root in relation to IAC contact.	80
18	Sensitivity, specificity and diagnostic accuracy of panorama in detecting deflection of root in relation to IAC contact.	80
19	Sensitivity, specificity and diagnostic accuracy of panorama in detecting dark & bifid root in relation to IAC contact.	81
20	Sensitivity, specificity and diagnostic accuracy of panorama in detecting interruption of RO line in relation to IAC contact.	81
21	Sensitivity, specificity and diagnostic accuracy of panorama in detecting diversion of the IAC in relation to IAC contact.	82
22	Sensitivity, specificity and diagnostic accuracy of panorama in detecting narrowing of the IAC in relation to IAC contact.	82
23	Sensitivity, specificity and diagnostic accuracy of panorama in detecting two or more signs of approximation in relation to IAC contact.	83
24	Sensitivity, specificity and diagnostic accuracy of panorama in detecting no signs of approximation in relation to IAC contact.	83
25	Sensitivity, specificity and diagnostic accuracy of panorama in detecting tooth position in relation to IAC contact.	84
26	Sensitivity, specificity and diagnostic accuracy of panorama in detecting angulation in relation to IAC contact.	84

List of Figures

Figure		Page
1	Variation in the course of mandibular canal	4
2	Trigeminal nerve and its branches	6
3	Diagrams revealing the panoramic radiographic findings associated	18
	with increased MN injury risk following impacted mandibular third	
	molar removal	
4	Multiple basis projections form the projection data from which	25
	orthogonal planar images are secondarily reconstructed	
5	Standard display modes of CBCT volumetric data	26
6	Bilateral linear oblique multiplanar reformation through lateral and	27
	medial poles of the mandibular condyle	
7	Curved MPR simulated "panoramic" image from CBCT showing	28
	CBCT applications in temporomandibular joint assessment	
8	Serial transplanar reformation from CBCT showing CBCT	29
	applications in nerve assessment	
9	Metallic streak artifacts of CBCT	33
10	Patient positioning on the panoramic machine.	41
11	The Workstation of the digital panoramic machine.	41
12	Patient positioning on the CBCT machine.	44 45
13	Local anesthetic nerve block technique.	
14	Three incision line pyramidal incision with Bard Parker blade	
	no.(15)	
15	Reflection of the mucoperiosteal flap with mucoperiosteal elevator.	46
16	Buccal and distal guttering of bone.	47
17	Tooth sectioning with low speed surgical bur.	47
18	Angled elevator was used to separate the sectioned crown.	48
19	Third molar roots after removal of the sectioned crown.	48
20	Inspection of bony crypt.	49
21	Smoothening bone margins and sharp edge of the bone with bone	49
22	file.	50
22	Wound closure using black silk or vicryl sutures three zero.	50
23	Light touch sensory test.	52
24	The area with impaired sensation.	53
25	Bar chart representing panoramic signs of approximation between	56
26	IAC and mandibular third molar.	57
26	Darkening of the roots.	57
27	Root Deflection.	57
28	Interruption of the Radiopaque border.	57

29	Dark and bifid apex.	57
30	Narrowing of canal.	57
31	Deflection of canal	57
32	Pie chart representing relationships of the mandibular third molar	
32	to the IAC.	58
33	Class I.	59
34	Class II.	59
35	Class III.	59
36	Pie chart representing different angulations of impacted	60
	mandibular third molar.	
37	Mesio-Angular Impaction.	61
38	Horizontal Impaction.	61
39	Vertical Impaction.	61
40	Pie chart representing different positions of the IAC in relation to	62
	the impacted mandibular third molar.	
41	Inferior canal position.	63
42	Lingual canal position.	63
43	Buccal canal position.	63
44	Pie chart representing contact between the IAC and the impacted	64
	mandibular third molar.	
45	Contact between IAC and impacted tooth.	65
46	No Contact between IAC and impacted tooth.	65
47	Bar chart representing different relations between the cortical plate	67
10	and the impacted mandibular third molar.	
48	No Contact with buccal.	68
49	Simple touch Bl and Lg.	68
50	Lingual Perforation.	68
51	Lingual Thinning.	68
52	Pie chart representing presence of numbness.	69
53	Cropped panoramic radiograph revealing a partially impacted left mandibular third molar.	85
54	CBCT screen image revealing axial (upper left), reformatted cross-sectional (upper right), reformatted panoramic(lower left)and	86
55	reconstructed 3D images. Reformatted cross-sectional image revealing an inferior position of the IAC with no contact between the canal and the roots.	87
56	Reformatted cross-sectional image at a more distal location revealing a buccal position of the IAC in relation to the distal root tip	87
57	Cropped panoramic radiograph revealing a horizontally impacted left mandibular third molar.	88

58	CBCT screen image revealing axial (upper left), reformatted cross-	89
	sectional (upper right), reformatted panoramic (lower left) and	
	reconstructed 3D images.	
59	Reformatted cross-sectional image at the level of the middle (right)	90
	and apical (left) thirds of the roots revealing inferior position of the	
	IAC with contact between the canal and the roots.	

List of Abbreviations

2D	two-dimensional.
3D	three-dimensional.
3D-CT	three-dimensional Computed tomography.
CBCT	Cone beam computed tomography.
CT	Computed tomography.
FOV	Field of view.
IAC	Inferior alveolar canal.
IAN	Inferior alveolar nerve.
MC	Mandibular canal.
MDCT	Multi-detector Computed tomography.
MN	Mandibular nerve.
MPR	Multiplanar reformation.
MRI	Magnetic resonance imaging.
MRN	Magnetic resonance neuroradiography.
MSCT	Multislice CT.
MSI	Magnetic spectroscopic imaging.
OMFS	Oral and Maxillofacial surgery.
TMJ	Tempromandibular joint.

