

UNIVERSITI TEKNOLOGI MARA

**CORTICAL BONE THICKNESS IN
DIFFERENT SAGITTAL SKELETAL
RELATIONSHIP: ASSESSMENT
AND PREDICTIVE MODELLING
USING ARTIFICIAL NEURAL
NETWORK**

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ABSTRACT

Introduction: Miniscrews as anchorage devices are being increasingly used by orthodontists. Cortical thickness is a major factor affecting the success of miniscrew placement. Orthodontists treat patients with different sagittal skeletal relations. Some clinicians use three-dimensional imaging for assessment of cortical thickness for miniscrew placement. **Objectives:** To assess buccal cortical thickness, interradicular distance and palatal cortical thickness in different sagittal skeletal relationship. The other objective of this study was to formulate a prediction model for buccal cortical thickness without exposing patients to three-dimensional imaging and high radiation dose. **Methods:** Archived cone beam computed tomography (CBCT) scans of 240 adult subjects with Class I, II and III sagittal skeletal relationship and normal vertical relation were used. The scans were divided into three groups of 80 subjects with equal gender distribution. Buccal cortical thickness and interradicular distance were measured in the alveolar processes of the maxilla and mandible. The sites measured were from between central incisors to the site between the two molars. Palatal cortical thickness was also measured at nine locations. Analysis of variance (ANOVA) with post-hoc Tukey test was used with a significance level of $p < 0.05$ to detect differences between sagittal skeletal classes. The sample's cortical bone thickness and interradicular distance mean values were used to formulate a deterministic prediction models for buccal cortical thickness in subjects with Class I, II and III sagittal skeletal relationship. Artificial neural network of the type, nonlinear autoregressive network with exogenous inputs (NARX), was employed to formulate the model. **Results:** Significant differences in buccal cortical thickness, interradicular distance and palatal cortical thickness were observed between different sagittal skeletal relationship. No significant gender differences were detected. The results for interradicular distance showed that Class I had the highest mean values, except for two sites. Anterior interradicular distance in all classes were less than 3 mm. Anterior cortical thickness higher than 1 mm was observed only in Class I, between lateral incisor and canine in both arches. In all skeletal classes, posterior cortical thickness for all sites were higher than 1 mm. Mandibular posterior cortical thickness increased posteriorly and were higher than their respective maxillary measurements. Palatal cortical thickness reduced posteriorly, with almost all sites having more than 1 mm thickness. Artificial neural network prediction models were formulated for all skeletal classes with validation R value in the range of 0.87-0.97. **Conclusions:** Sagittal skeletal relation needs to be considered in miniscrew placement. Artificial neural network prediction models can be used to estimate buccal cortical thickness without exposing patients to three-dimensional imaging.

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TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF SYMBOLS	xvii
LIST OF ABBREVIATIONS	xviii
CHAPTER ONE: INTRODUCTION	1
1.1 Background of The Study	1
1.1.1 The Maxilla and Mandible	1
1.1.2 Bone Morphology	2
1.1.3 Orthodontic Anchorage with Miniscrews	3
1.1.4 Bone Imaging	5
1.1.5 Mathematical Modelling	7
1.1.6 The Need for Prediction of Buccal Cortical Thickness	9
1.2 Problem Statement	11
1.3 Objectives	14
1.4 Hypotheses	14
1.5 Significance of The Study	15
1.6 Scope and Limitation of The Study	16
CHAPTER TWO: LITERATURE REVIEW	17
2.1 The Maxilla and Mandible	17
2.1.1 The Alveolar Process	17
2.1.2 Cortical Bone Thickness	18
2.2 Imaging in Dentistry	20

2.2.1	Computed Tomography (CT)	21
2.2.2	Cone-Beam Computed Tomography (CBCT)	21
2.2.3	CBCT in Dentistry	23
2.2.4	Applications of CBCT in Orthodontics	29
2.2.5	Accuracy of Linear Measurements Using CBCT	38
2.2.6	Safety of Cone Beam Computed Tomography	41
2.3	Temporary Anchorage Devices (TADs)	49
2.3.1	Miniscrews in Orthodontics	49
2.3.2	Miniscrew Site Evaluation	51
2.4	Race and Ethnicity Considerations	52
2.5	Radiation Guidelines and Regulations	53
2.5.1	Clinical Considerations on Ionizing Radiation in Orthodontics	56
2.5.2	Recommendations on CBCT Use for Miniscrew Placement	57
2.6	Current Knowledge on Variations in Cortical Bone Thickness	58
2.7	Cortical Bone Thickness in Different Sagittal Skeletal Relationship	63
2.8	Palatal Cortical Thickness	65
2.9	Clinical Implications	67
2.10	Studies on Malaysian Malay population	67
2.11	Mathematical Models in Biology	70
2.12	Mathematical Models in Medicine	72
2.13	Mathematical Models of Bone Biology	73
2.14	Prediction Models in Dentistry	73
2.15	Modern Computational and Mathematical Techniques	74
2.16	Artificial Intelligence (AI)	75
2.17	Artificial Neural Networks (ANNs)	76
2.17.1	Historical Background	77
2.17.2	Characteristics of ANNs	78
2.18	Modelling with ANNs	79
2.19	The Specific Case of Orthodontics	82
2.20	Uses of ANNs in Biomedical Field	83
2.21	Uses of ANNs in Dentistry	84
2.22	Other Modes of Artificial Intelligence (AI) in Orthodontics	85
2.23	Computational Programs for ANNs Training	86