

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iv
ABSTRACT (THAI)	iv
ABSTRACT (ENGLISH)	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
ABBREVIATIONS AND SYMBOLS	xiii
CHAPTER I INTRODUCTION	1
1.1 Principles, Theory, Rationale and/or Hypotheses	1
CHAPTER II LITERATURE REVIEW	9
CHAPTER III OBJECTIVE, MATERIAL AND METHOD	12
Objective	12
Material	12
Method	15
CHAPTER IV RESULTS	23
CHAPTER V DISCUSSION	35
CHAPTER VI CONCLUSION	41
BIBLIOGRAPHY	42
CURRICULUM VITAE	45

LIST OF TABLES

Table		Page
1	The physical properties of titanium alloy and human jaw bone components.	20
2	The Von Mises stress and total displacement compared between type A, B and C OMI's in bone models in three loading force (2, 5 and 10 N) at the direction of 0 degree.	24
3	The Von Mises stress and total displacement compared between type A, B and C OMI's in bone models in three loading force (2, 5 and 10 N) at the direction of 30 degree.	24
4	The Von Mises stress and total displacement compared between type A, B and C OMI's in bone models in three loading force (2, 5 and 10 N) at the direction of 45 degree.	25
5	The Von Mises stress and total displacement compared between type A, B and C OMI's in bone models in three loading force (2, 5 and 10 N) at the direction of 60 degree.	25
6	The Von Mises stress and total displacement compared between type A,B and C OMI's in bone models in three loading force (2, 5 and 10 N) at the direction of 90 degree.	26

LIST OF FIGURES

Figure	page
1 Severe tooth crowding: the lack of spaces on upper and lower jaws causing crowded or overlapped teeth.	2
2 Severe openbite: the space between the upper and lower front teeth caused by habits such as thumb sucking or tongue posturing.	2
3 Anterior crossbite: the wrong position of upper front teeth (stay behind the lower front teeth) may cause tooth stratification and misaligned jaw growth.	3
4 Class II malocclusion: the protrusion of upper front teeth causes the large horizontal gap between upper and lower front teeth.	3
5 Class III malocclusion: the protrusion of lower front teeth produces a negative overbite.	4
6 Occlusal plane canting: the occlusal plane rises toward the left side which make imbalance between the right and the left side.	4
7 Thai orthodontic miniscrew implant (Thai OMI) and its components.	7
8 Orthodontic tooth movement treated by orthodontic miniscrew implant (yellow arrows).	8
9 Dual-Top (Jeil Medical Corp., Korea)	13
10 Ortho Easy (Forestadent, Germany)	14
11 Video measuring machine.	15
12 The 2D figures of three OMIs.	16
13 Type A OMI (AMI) was transferred from 2D figure to 3D figure by computer aided design (CAD) technique.	17
14 The bone model which consists of 1mm thickness of cortical bone and 3mm thickness of cancellous bone.	18

15	Three types of OMI model were inserted into the bone model.	19
16	Finite element mesh OMI was inserted around the bone model.	19
17	The OMI models were seated in the bone model and the different loading force (2, 5, 10 N) were at 0°, 30°, 45°, 60°, 90°.	21
18	Each color showed the stress distribution on each loaded area.	22
19	The line graph showed Von Mises Stress of three type OMIs (A,B,C) at the loading force of 2N in five different directions (0°,30°,45°,60°,90°).	26
20	Type B OMI models showed stress distribution pattern at 2 N in five different directions(0°,30°,45°,60°,90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value.	27
21	Type C OMI models showed stress distribution pattern at 2 N in five different directions(0°,30°,45°,60°,90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value.	27
22	The line graph showed Von Mises Stress of three type OMIs (A,B,C) at the loading force of 5N in five different directions (0°,30°,45°,60°,90°).	28
23	Type B OMI models showed stress distribution pattern at 5 N in five different directions(0°,30°,45°,60°,90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value.	28
24	Type C OMI models showed stress distribution pattern at 5 N in five different directions(0°,30°,45°,60°,90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value.	29
25	The line graph showed Von Mises Stress of three type OMIs (A,B,C) at the loading force of 10N in five different directions (0°,30°,45°,60°,90°).	30

- 26 Type B OMI models showed stress distribution pattern at 10 N in five different directions(0° , 30° , 45° , 60° , 90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value. 30
- 27 Type C OMI models showed stress distribution pattern at 10 N in five different directions(0° , 30° , 45° , 60° , 90°). Different colors band represented the stress distribution from lower (BLUE) to higher (RED) value. 31
- 28 The line graph showed total displacement of three type OMIs (A,B,C) at the loading force of 2N in five different directions (0° , 30° , 45° , 60° , 90°). 32
- 29 The line graph showed total displacement of three type OMIs (A,B,C) at the loading force of 5N in five different directions (0° , 30° , 45° , 60° , 90°). 32
- 30 The line graph showed total displacement of three type OMIs (A,B,C) at the loading force of 10N in five different directions (0° , 30° , 45° , 60° , 90°). 33

ABBREVIATIONS AND SYMBOLS

°	Degree
µm.	Micrometre
N	Newton
Ti	Titanium
mm.	Millimeter
≥	More or equal
MPa	Megapascal
GPa	Gigapascal
cN	Centi Newton
cm ²	square centimetre
lb/in ³	Pound per cubic inch