

TABLE OF CONTENTS

CONTENTS	PAGE
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
LIST OF TABLES	x
LIST OF ILLUSTRATIONS	xi
CHAPTER I INTRODUCTION	1
Principles, theory, rationale and hypothesis	1
Purposes of the study and hypothesis	2
Anticipated benefits	3
Scope of the study	3
Glossary of terms	3
CHAPTER II LITERATURE REVIEW	5
The magnetic materials	5
The extent and flux density of static magnetic fields	9
The magnetic force generated by the magnets	11
A. Factors influencing magnetic forces	11
B. Force and flux relationship	17
The biological effect of the magnets	18
Clinical application of magnets	19
CHAPTER III MATERIALS AND METHODS	23
Materials	23
Methods	29
Statistical analysis	34

CONTENTS	PAGE
CHAPTER IV RESULTS	36
Part I : The forces generated by the commercial and orthodontic magnets	36
Part II : The composition and crystal structure of the commercial and orthodontic magnets	43
CHAPTER V DISCUSSION	53
Part I : The forces generated by the commercial and orthodontic magnets	53
Part II : The composition and crystal structure of the commercial and orthodontic magnets	59
Limitations of this investigation	60
Suggestions of further study	61
CHAPTER VI CONCLUSION	62
BIBIOGRAPHY	64
APPENDIX	68
CURRICULUM VITAE	74

LIST OF TABLES

TABLES		PAGE
2.1	The magnetic properties of various permanent magnet materials	9
3.1	Sample distribution in the five groups	29
4.1	Means, standard deviations and estimation of means of magnetic forces generated by orthodontic magnet (3.7mm. ϕ x 2.0 mm.) and commercial magnets (3.28x3.28x2.0 mm., 6.0x6.0x2.0 mm., 8.0x8.0x2.0 mm., 10.0x10.0x2.0 mm.)	37
4.2	t- test between mean of magnetic force of orthodontic magnets (3.7mm. ϕ x 2.0 mm.), commercial magnets (3.28x3.28x2.0 mm.) attracting to orthodontic bracket in various distances.	40
4.3	One way ANOVA and multiple comparisons of magnetic force among three sizes of commercial magnets in various distances by Scheffe's multiple range test	42
4.4	X-ray diffraction data of orthodontic magnet	50
4.5	X-ray diffraction data of commercial magnet	51
A.1	The data of magnetic forces of orthodontic magnets (3.7mm. ϕ x 2.0 mm.)	69
A.2	The data of magnetic forces of commercial magnets (3.28x3.28 x 2.0 mm.)	70
A.3	The data of magnetic forces of commercial magnets (6.0x6.0x 2.0 mm.)	71
A.4	The data of magnetic forces of commercial magnets (8.0x8.0x 2.0 mm.)	72
A.5	The data of magnetic forces of commercial magnets (10.0x10.0x 2.0 mm.)	73

LIST OF ILLUSTRATIONS

FIGURES	PAGE
2.1 Hysteresis loop of soft and hard magnetic materials	6
2.2 The magnetic field of repelling magnets	10
2.3 Flux comparisons of different thickness of magnets	11
2.4 Change in force magnitude with respect to distance between magnets in different magnets dimension	13
2.5 Force produced between two magnets	14
2.6 Force-distance curve. A–repelling position, B–attractive position, C–combined repelling and attracting position	15
3.1 The orthodontic magnets	24
3.2 The commercial magnets	24
3.3 Universal testing machine	25
3.4 Mounting jigs	26
3.5 Electronic digital caliper	26
3.6 Scanning electron microscope (SEM), model JSM – 840A	27
3.7 X-ray microanalysis, Link QX-2000	28
3.8 X-ray diffractometer (XRD), model JDX-8030	28
3.9 The orthodontic magnet embedded in polyvinylchloride tube	30
3.10 Four sizes of commercial magnets embedded in polyvinylchloride tube	31
3.11 Orthodontic bracket embedded in centric position of upper mounting jig	31
3.12 Magnet embedded in polyvinylchloride tube fitted in the lower mounting jig	32
3.13 The upper and lower mounting jigs were fitted into the upper and lower pneumatic grips	32

FIGURES	PAGE
4.1 Force – distance curve of orthodontic magnets (3.7mm. ϕ x 2.0 mm.) and commercial magnets (3.28x3.28x2.0 mm., 6.0x6.0x2.0 mm., 8.0x8.0x2.0 mm., 10.0x10.0x2.0 mm.)	38
4.2 Force – distance curve of orthodontic magnets (3.7mm. ϕ x 2.0 mm.) and commercial magnets (3.28x3.28x2.0 mm.)	41
4.3 SEM photomicrograph showed morphology of orthodontic magnet surface	43
4.4 SEM photomicrograph showed morphology of commercial magnet surface	44
4.5 Graph showed Intensity of each component in dark grain of orthodontic magnet	45
4.6 Graph showed intensity of each component in light grain of orthodontic magnet	46
4.7 Graph showed intensity of each component in dark grain of commercial magnet	47
4.8 Graph showed intensity of each component in light grain of commercial magnet	48
4.9 X-ray diffraction pattern of orthodontic magnet	50
4.10 X-ray diffraction pattern of commercial magnet	51