TABLE OF CONTENTS

Content		Page
ACKNOWLEI ABSTRACT	DGEMENTS	iii iv
LIST OF TAB	BLES S	х
LIST OF ILLU	JSTRATIONS	xii
CHAPTER I	INTRODUCTION	1
	Principle, theory, and rationale	1
	The objective of the study	2
	The hypothesis	2
	Anticipated benefits	3
	Scope of the study	3
CHAPTER II	LITERATURE REVIEW	4
	I. Effect of orthodontic tooth movement on periodontium	4
	II. Gingival crevicular fluid (GCF)	6
	III. Glycosaminoglycans (GAGs)	7
	IV. Hyaluronic acid (HA)	8
	V. ELISA-liked assay for HA	12
CHAPTER III	MATERIALS AND METHODS	S 14
	Materials T C C C C C C C C C C C C C C C C C C	-14
	Methods	19
	Statistical analyses	21

viii

 CHAPTER IV RESULTS Part I: The descriptions of the patients Part II: The clinical scores Part III: The changes in HA level per unit protein Part IV: Comparisons of the HA level per unit protein during the leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study BIBLIOGRAPHY 		
 Part I: The descriptions of the patients Part II: The clinical scores Part III: The changes in HA level per unit protein during the leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study BIBLIOGRAPHY 	CHAPTER IV RESULTS	22
 Part II: The clinical scores Part III: The changes in HA level per unit protein Part IV: Comparisons of the HA level per unit protein during the leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study DIBLIOGRAPHY 	Part I: The descriptions of the patients	22
 Part III: The changes in HA level per unit protein Part IV: Comparisons of the HA level per unit protein during the leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study 	Part II: The clinical scores	23
 Part IV: Comparisons of the HA level per unit protein during the leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study BIBLIOGRAPHY 	Part III: The changes in HA level per unit protein	24
leveling phase (L-phase), the first eight weeks of canine movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	Part IV: Comparisons of the HA level per unit protein during the	
movement phase (M-phase), and after complete orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	leveling phase (L-phase), the first eight weeks of canine	
orthodontic canine movement phase (S-phase) Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	movement phase (M-phase), and after complete	
Part V: Comparisons of the HA level per unit protein between canines and incisors in every treatment phase CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	orthodontic canine movement phase (S-phase)	28
CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	Part V: Comparisons of the HA level per unit protein between	
CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY	canines and incisors in every treatment phase	30
CHAPTER V DISCUSSION Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY		
Limitation of this study Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY APPENDIX	CHAPTER V DISCUSSION	32
Suggestions for further study CHAPTER VI CONCLUSION BIBLIOGRAPHY APPENDIX	Limitation of this study	37
CHAPTER VI CONCLUSION BIBLIOGRAPHY APPENDIX	Suggestions for further study	39
CHAPTER VI CONCLUSION BIBLIOGRAPHY APPENDIX		
BIBLIOGRAPHY APPENDIX	CHAPTER VI CONCLUSION	40
BIBLIOGRAPHY APPENDIX		
	BIBLIOGRAPHY	41
JAPPENDIX UNIONSIA SUBJOLI		
	APPENDIX	46

Coperrie by Chiang Mai Univers⁵⁵ All rights reserved

ix

Page

Content

LIST OF TABLES

Table ABLE ABLA	Page
3.1 A score used to evaluate Gingival Index (GI).	16
3.2 A score used to evaluate Plaque Index (PI).	16
4.1 A summary of the patients' profiles in this study: patients' code, tooth	
number, age, and sex.	22
4.2 The means (standard deviations) of plaque index (PI) and gingival index (GI)	
before, during, and after complete orthodontic canine movements.	23
4.3 The mean rank of plaque index (PI) and gingival index (GI) scores of all	
four patients before, during, and after complete orthodontic canine	23
movements (n = 4).	
4.4 The non-parametric statistical analysis (Friedman Test) of plaque index (PI)	
and gingival index (GI) scores.	24
4.5 The medians of HA level per unit protein $(ng/\mu g)$ of canines (n=7) and	
incisors (n=3) during the leveling phase, the first eight weeks of canine	
movement phase (M0, M1, M2, M3,, and M8), and after complete	
orthodontic canine movement phase (S1, S2, S3,, and S8).	28
4.6 The non-parametric statistical analysis (Friedman Test) of HA level per	
unit protein of canines and incisors.	30
4.7 The non-parametric statistical analysis (Mann-Whitney U Test) of the	
medians of HA level per unit protein between canines (n = 7) and	
incisors (n = 3) in every treatment phase.	e ³¹ 0

Table	Page
A.1 Protein levels, HA levels, HA levels per unit protein of GCF samples from	
C11, C13	47
A.2 Protein levels, HA levels, HA levels per unit protein of GCF samples from	
D11, D13, and D23	49
A.3 Protein levels, HA levels, HA levels per unit protein of GCF samples from	
E11, E13, and E23	51
A.4 Protein levels, HA levels, HA levels per unit protein of GCF samples from	
H13, H23	53

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่ Copyright © by Chiang Mai University All rights reserved

xi

LIST OF ILLUSTRATIONS

Figure

Page

4.1	The duration of a longitudinal study.	24
4.2	Intraoral photographs	25
4.3	A linear graph demonstrated HA level per unit protein (ng/ μ g) of tooth	
	C11 (Blue) and C13 (Pink). The red arrows indicated the time when a	
	new closed coil spring was changed and the force was therefore	
	applied to the experimental tooth, C13.	26
4.4	A linear graph demonstrated HA level per unit protein (ng/µg) of tooth	
	D11 (Blue), D13 (Pink), and D23 (Green). The red arrows indicated the	
	time when a new closed coil spring was changed and the force was	
	therefore applied to the experimental teeth, D13 and D23.	27
4.5	A Linear graph demonstrated the medians of HA level per unit protein	
	(ng/ μ g) of canines (n=7, Blue) and incisors (n=3, Pink) in the leveling phase,	
	the first eight weeks of canine movement phase (M0, M1, M2, M3,,and	
	M8), and the complete canine movement phase (S1, S2, S3,, and S8).	29

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่ Copyright © by Chiang Mai University All rights reserved

xii