

	Page
· 1918126	
2.2.1 Migraine without aura (common migraine)	14
2.2.2 Migraine with aura (classical migraine)	14
2.2.3 Typical aura with migraine headache	15
2.2.4 Typical aura with non-migraine headache	16
2.2.5 Typical aura without headache	17
2.2.6 Familial hemiplegic migraine (FHM)	18
2.2.7 Sporadic hemiplegic migraine	19
2.2.8 Basilar-type migraine	20
2.3 Treatment for migraine	
2.3.1 Treatment of acute migraine headaches	22
2.3.2 Preventive treatment for migraine	23
2.4 Health risks from the use of mobile phones	
2.4.1 What is radiofrequency (RF) energy?	27
2.4.2 How is radiofrequency energy used?	28
2.4.3 How is radiofrequency radiation measured?	29
2.4.4 What biological effects can be caused by RF energy?	30
2.4.5 Mechanisms of biological effects from exposed to RF	e ₃₃ 0
2.4.5.1 Thermal effects	34
2.4.5.2 Non-thermal effects	34

		Page
	. กายเหติ .	
2.5 P	revious relevant studies	
6	2.5.1 Biological effects from exposed to RF radiation	35
5	2.5.2 Temperature change from exposure to RF	43
6	2.5.3 Brain activity change from exposure to RF	46
202	2.5.4 Effects of RF exposure to nervous systems	47
205	2.5.4.1 Effect on cell membrane	47
	2.5.4.2 Calcium efflux	48
I H	2.5.4.3 Neurotransmitter systems	49
	2.5.5 Symptoms associated with mobile phone use	50
	2.5.6 Reduction in exposure RF by using hand-free	54
	accessories	

2.5.7 Other precipitating factors for migraine headache 57



xii

	· 978181869 .	Page
3.5 R	esearch instrument	
6	3.5.1 Questionnaire design	67
5	3.5.2 Outcomes assessment	68
6	3.5.2.1 Primary outcomes	68
STR	3.5.2.2 Secondary outcomes	68
205	3.5.3 Headache diary form	68
	3.5.4 Hospital Anxiety and Depression Scale	69
3.6 D	Pata collection	70
3.7 D	ata analysis	70

CHAPTER 4 RESULTS

4.1 The information of patients' illness at baseline		
4.1.1 Patients	73	
4.1.2 Demographic characteristics of eligible subjects	75	
4.1.3 Past history of headache	77	
4.1.4 Clinical manifestations of present history of headache	78	
4.1.5 Factors associated with migraine headache	820	
4.1.6 Information of mobile phone use	84	
4.2 Test of carry over effect, treatment effect and period effect	86	

xiii

	Page
· 181816	
4.3 Comparison of mean difference of outcomes	
4.3.1 Comparison of primary outcomes between each group	94
4.3.2 Comparison of primary outcomes between each pair	96
4.3.3 Comparison of outcomes between non mobile phone	98
exposure and mobile phone exposure group in sequence 2	
4.3.4 Comparison of other factors between each period	100
4.3.5 Comparison of mean difference of primary outcomes after	104
adjusted covariate factors	
4.3.6 Comparison in subgroup analysis	108
4.3.6.1 Group A estimation between baseline and	108
hand-free use group	
4.3.6.2 Group B estimation between baseline and	110
non hand-free use group	
4.3.6.3 Comparison between groups A and B in	111
sequence 1 4.4 Correlation of mobile phone use and primary outcomes	Sity 111
All rights reserve	e d

xiv

REFERENCES

		I uge
0.9	ปลายหตุ	
APPENDICES	0,00 62	
APPENDIX A:	Research plan	141
APPENDIX B:	Calendar of visit	142
APPENDIX C:	Study protocol	143
APPENDIX D:	IHS diagnostic criteria	144
APPENDIX E:	Consent form	145
APPENDIX F:	Information sheet for patients	146
APPENDIX G:	Questionnaire form 1, 2	150
APPENDIX H:	Physical examination form	161
APPENDIX I:	Headache diary form	162
APPENDIX J:	Diary of mobile phone use form	164
APPENDIX K:	Hospital anxiety and depression scale form	165
APPENDIX L:	Assessment form for each visit	167
APPENDIX M:	Mean difference of primary outcomes and	168
	secondary outcomes for carry over effect,	31LY
All rig	treatment effect and period effect	e d

XV

CURRICULUM VITAE

171

LIST OF TABLES

Table

Page

	MALIKO .	
Table		Page
	5 5 30	
2	.1 Drugs for acute migraine and for prevention: efficacy, adverse	25
6	effects, relative contraindications, and indications	
2	.2 Typical portable/mobile radio equipment	26
203	.1 Medication for acute attack and preventive treatment	67
	for migraine patients	
4	.1 Demographic characteristics of study population at baseline	75
4	.2 Previous headache and past history illness of study population at	77
	baseline	
4	.3 Clinical manifestations of present history of headache at baseline	79
4	.4 Stimulated factors for migraine among female group at baseline	83
4	.5 Stimulated factors for migraine of study population at baseline	83
ลิขสิน	.6 Information of mobile phone use of study population	85
	at baseline 7 Mean difference of carry over effect	168
	.8 Mean difference of treatment effect e S e r v	169
4	.9 Mean difference of period effect	170
4	.10 Mean difference of primary outcomes between baseline,	95
	hands-free use group and non hands-free use group comparison	

Table	Page
· 1818180 .	
4.11 Mean difference of primary outcomes between each pair	97
4.12 Comparison of outcomes between hands-free use and non	99
hands-free use group in sequence 2	
4.13 Covariate factors for migraine	101
4.14 Adjusted mean difference of primary outcomes for each group	105
by comparison	
4.15 Adjusted mean difference of primary outcomes between each pair	107
4.16 Comparison of outcomes between baseline and hands-free use	109
group in group A	
4.17 Comparison of outcomes between baseline and non hands-free use	110
group in group B	
4.18 Correlation of mobile phone use duration grading and primary	112
outcomes (Spearman's correlation)	
4.19 Correlation of mobile phone use frequency and primary outcomes	114
(Spearman's correlation)	itv
4.20 Correlation in the time of a call on a mobile phone and primary	116
outcomes (Pearson's correlation)	e d

xvii

LIST OF FIGURES	
Figure A B B B B B B B B B B B B B B B B B B	Page
1.1 Conceptual framework	6
2.1 Role of neuropeptides in the pathophysiology of migraine	10
2.2 Cortical spreading depression: The relation between cortical	12
spreading depression (CSD) and headache in migraine with aura	
2.3 Electromagnetic wave passing through 1 m ²	30
2.4 The Electromagnetic Spectrum	32
4.1 Participant flow and follow-up	74
4.2 Number of migraine attacks per month	87
4.3 Number of days with migraine attacks per month	88
4.4 Total intensity scores per month	88
Copyright [©] by Chiang Mai Univer	sity
4.5 Total severity scores per month	89
4.6 Total duration scores per month	90 90
4.7 Amount of acute medication per month	90
4.8 Number of days with acute medication per month	91

xviii

Page

Figure

Figure ABERG	Page
4.9 Patient's Global Assessment	
4.9 Patient's Global Assessment	92
4.10 Investigator's Global Assessment	92
4.11 Scatter plot showed the relationship between duration grading of	113
mobile phone use and migraine attacks in non hands-free use group	
4.12 Scatter plot showed the relationship between mobile phone use	115
frequency and migraine attacks in hands-free use group	
4.13 Scatter plot showed the relationship between mobile phone use	115
frequency and the days with migraine attacks in hands-free use grou	р
4.14 Scatter plot showed the relationship between the time of a call on a	117
mobile phone and migraine attacks at baseline phase	
4.15 Scatter plot showed the relationship between the time of a call on a	117
mobile phone and migraine attacks in non hands-free use group	1 IJ
Copyright [©] by Chiang Mai Univers	ity
All rights reserve	e d

ABBREVIATIONS AND ACRONYMS

		กมยนติ
	AA	Arachidonic Acid
	Ache	Acetylcholine
	A/m	Amperes per meter
Sec.	АМ	Amplitude Modulation
	ANOVA	Analysis of Variances
	BBB	Blood-brain barrier
	BP	Bereitschaftspotential
	BT-A	Botulinum toxin type A
	CAs	Chromosome Aberrations
	CGRP	Calcitonin Gene-Related Peptide
	CNS	Central Nervous System
	CNV	Contingent Negative Variation
	CSD	Cortical Spreading Depression
ลิขส	EEG	Electroencephalography
Copy A I I	EM	Electromagnetic
	EMF	Electromagnetic Radiofrequency
	ETTH	Episodic Tension-Type Headache
	FDTD	Finite-Difference Time-Domain
	FHM	Familial Hemiplegic Migraine
	FM	Frequency Modulation

XX

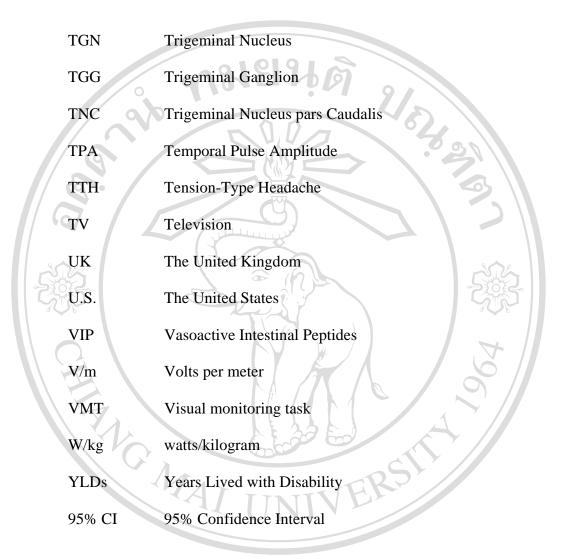
	GHz	Gigahertz
âaâ Copy A I I	GnRHa	Gonadotropin-Releasing Hormone Agonists
	GSM	Digital System/ Global System of Mobile Communication
	HF	Hand-free use group
	HP	Cellular Telephone
	Hsp	Heat Shock Protein
	HZ	Hertz
	ICNIRP	International Commission for Non-Ionizing Radiation
	\sim	Protection
	IHS	International Headache Society
	IQR	Interquartile Range
	kHZ	Kilohertz
	Lao PDR	Lao Public Democracy Republic
	МА	Migraine with Aura
	MHZ	Megahertz
	MP ₃	Media Player 3 9 9 8 8 1 8 8 0 1 M 1
	MP	Mobile Phone by Chiang Mai University
	mW/cm ²	Milliwatts Per Square Centimeter
	mW/g	Milliwatts per gram
	MwA/MO	Migraine with aura/migraine without Aura
	MW	Microwave
	Ν	Noise

xxi

	NA	Negative Affect
	NCRP	National Council on Radiation Protection and Measurements
	NMT	Analogue System
	NO	Nitric Oxide
	Non-HF	Non hand-free use group
	NPD	Neutralising Protective Device
	NSAIDS	Nonsteroidal Anti-inflammatory Drugs
	OHS	Olfactory Hypersensitivity
	PCS	Personal Communication Systems
	PHF	Personal hand-free
	PMS	Premenstrual Symptoms
	REM	Rapid Eye Movement
	RFR	Radiofrequency Radiation
	RF	Radiofrequency
	ROS	Reactive Oxygen Species
ີລິບສິ	INS I	Stressor วิทยาลัยเชียงไทบ
Cont	SAR	Specific Absorption Rate
Copy	S.D	Standard Deviation
	SPG	Sphenopalatine Ganglion e s e r v e o
	SSN	Superior Sagital Sinus
	SWS	Slow Wave Sleep
	TANMH	Typical Aura with Non-Headache

xxii

xxiii



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่ Copyright[©] by Chiang Mai University All rights reserved