การวิเคราะห์สาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่นด้วยกล้องวิดีโอ

นายดิฏฐชัย จันทร์คุณา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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VIDEO ANALYSIS FOR THE CAUSES OF HEAD AND FACE INJURIES IN AMATEUR MUAYTHAI BOXERS

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A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Science Program in Sports Medicine

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ดิฏฐชัย จันทร์คุณา : การวิเคราะห์สาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่นด้วยกล้องวิดีโอ. (VIDEO ANALYSIS FOR THE CAUSES OF HEAD AND FACE INJURIES IN AMATEUR MUAYTHAI BOXERS) อ.ที่ปรึกษา : อ. นพ. อิ๊ด ลอประยูร, อ.ที่ปรึกษาร่วม : รศ. นพ. พงศ์ศักดิ์ ยุกตะนันทน์, 73 หน้า.

การแข่งขันมวยไทยสามารถใช้อาวุธมวยไทยอันได้แก่ หมัด, เท้า, เข่า, และศอก ซึ่งอาจเป็นสาเหตุของการบาดเจ็บบริเวณศีรษะและใบหน้า อันจะส่งผลให้ชีวิตของผู้เข้าแข่งขันไม่ยืนยาว การศึกษาเกี่ยวกับการบาดเจ็บบริเวณศีรษะและใบหน้าเท่าที่มีอย่างจำกัดและขาดความแม่นยำในระเบียบวิธีวิจัย โดยเฉพาะในกีฬามวยไทยสมัครเล่น ทำให้ขาดข้อมูลที่จะพัฒนาการป้องกันการบาดเจ็บดังกล่าว จุดมุ่งหมายของการวิจัยนี้มี 3 ประการ คือ 1) เพื่อวิเคราะห์สาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่น 2) เพื่อหาความสัมพันธ์ระหว่างปัจจัยภายนอกอื่นๆ ที่ไม่ใช่อาวุธมวยไทยกับการบาดเจ็บบริเวณศีรษะและใบหน้า และ 3) เพื่อสำรวจชนิดและอัตราการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่น โดยเก็บข้อมูลจากการบันทึกวิดีโอการแข่งขันและรวบรวมข้อมูลการบาดเจ็บด้วยแบบบันทึกข้อมูลการบาดเจ็บกีฬามวยไทยสมัครเล่นในนักกีฬามวยไทยสมัครเล่น 341 คน จากการแข่งขันกีฬามวยไทยสมัครเล่น 3 รายการที่จัดขึ้นในประเทศไทยแล้วใช้เทคนิคการวิเคราะห์ภาพแบบเฟรมต่อเฟรมเพื่อคัดแยกสาเหตุ, ตำแหน่ง, จำนวน, ชนิด, และอัตราการบาดเจ็บบริเวณศีรษะและใบหน้าจากอาวุธมวยไทยร่วมกับแบบบันทึกข้อมูลการบาดเจ็บกีฬามวยไทยสมัครเล่น

ผลการวิจัยพบว่า เกิดการบาดเจ็บบริเวณศีรษะและใบหน้า 30 ราย จากจำนวน 907 ยก (290 นัด) หรือคิดเป็น 33.1 การบาดเจ็บต่อ 1,000 ยก สาเหตุการบาดเจ็บส่วนใหญ่ได้แก่ หมัด (18 การบาดเจ็บ, 19.8 การบาดเจ็บต่อ 1,000 ยก) รองลงมาได้แก่ เท้า (8 การบาดเจ็บ, 8.8 การบาดเจ็บต่อ 1,000 ยก), เข่า (2 การบาดเจ็บ, 2.2 การบาดเจ็บต่อ 1,000 ยก), และ ศอก (2 การบาดเจ็บ, 2.2 การบาดเจ็บต่อ 1,000 ยก) ตามลำดับ โดยหมัดและเท้าเป็นสาเหตุหลักของการบาดเจ็บต่อสมองชนิดสมองได้รับความกระทบกระเทือน (Concussion) (13 การบาดเจ็บ, 14.3 การบาดเจ็บต่อ 1,000 ยก และ 7 การบาดเจ็บ, 7.7 การบาดเจ็บต่อ 1,000 ยก ในหมัดและเท้าตามลำดับ) แต่ไม่พบความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ (χ^2= 20.580, p=.057 และ χ^2= 12.246, p=.426 ในตำแหน่งและชนิดการบาดเจ็บตามลำดับ) การได้รับความกระทบกระเทือนทางสมองระดับ 1 เป็นชนิดการบาดเจ็บที่เกิดขึ้นมากที่สุด (10 การบาดเจ็บ, 11.0 การบาดเจ็บต่อ 1,000 ยก) และการลดน้ำหนักอาจมีความสัมพันธ์กับการบาดเจ็บบริเวณศีรษะและใบหน้า สรุปผลการวิจัยได้ว่า การชกกับการเตะมีความอันตรายต่อศีรษะและใบหน้ามากกว่าการใช้เข่าและศอกอย่างไรก็ตาม อาวุธมวยไทยทุกชนิดสามารถทำให้เกิดการบาดเจ็บต่อศีรษะและใบหน้าได้ทั้งสิ้น

สาขาวิชา.....เวชศาสตร์การกีฬา.....ลายมือชื่อนิสิต.....

ปีการศึกษา.....2549..... ลายมือชื่ออาจารย์ที่ปรึกษา.....

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KEY WORD: MUAYTHAI / HEAD INJURIES / FACE INJUREIS / VIDEO ANALYSIS / INJURY RATE

DITTACHAI CHANKUNA : VIDEO ANALYSIS FOR THE CAUSES OF HEAD AND FACE INJURIES IN AMATEUR MUAYTHAI BOXERS. THESIS ADVISOR : EAD LORPRAYUN, M.D., THESIS CO-ADVISOR : ASSOC. PROF. PONGSAK YUKTANANDANA, M.D., 73 pp.

Fists, feet, knees, and elbows are Muaythai weapons use during Muaythai competitions. These may cause head and face injuries (HFI) and later diminish longevity of participants. Lack of precise methodological study in amateur Muaythai restricted information to improve HFI prevention. The objectives of this study were, firstly, to analyze the causes of HFI in amateur Muaythai boxers (AMB). Secondly, to determine relationship between external factors (not Muaythai weapons) and HFI. Finally, to investigate the types and rates of HFI sustained in AMB. Video records and injury information from the amateur Muaythai injury record form (AMIRF) of 341 AMB, obtained from three amateur Muaythai competitions held in Thailand, were collected prospectively. Frame by frame technique was used to analyze cause, distribution, frequency, type, and rate of HFI resulting from Muaythai weapons in conjunction with AMIRF.

A total of 30 HFI occurred during 907 rounds (290 bouts) of Muaythai. The injury rate was 33.1 injuries per 1,000 rounds. The most common cause of HFI is a fist (18 injuries, 19.8 injuries per 1,000 rounds), followed by a foot (8 injuries, 8.8 injuries per 1,000 rounds); a knee (2 injuries, 2.2 injuries per 1,000 rounds); and an elbow (2 injury, 2.2 injuries per 1,000 rounds) respectively. A fist and a foot were most common in causing cerebral concussion (13 injuries, 14.3 injuries per 1,000 rounds and 7 injuries, 7.7 injuries per 1,000 rounds for a fist and a foot respectively). The differences in causes of types and sites of HFI were not statistical significant (χ^2= 20.580, p=.057 and χ^2= 12.246, p=.426). Grade 1 concussion occurred most frequently (10 injuries, 11.0 injuries per 1,000 rounds). Weight reduction was external factor may related to head and face injuries. In conclusion, punching and kicking were more dangerous than kneeing and elbowing, although all Muaythai weapons can damage head and face.

Field of study.....Sports Medicine..... Student's signature.....

Academic year.....2006..... Advisor's signature.....

Co-advisor's signature.....

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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

BACKGROUND AND RATIONAL

Muaythai is the martial art of Thailand. It is part of the Thai heritage. During a match, all parts of the body are allowed to be used in attacking and defending. Punching, kicking, kneeing, and elbowing are known as Muaythai weapons (1-8). As injury may occur in martial art, Muaythai is no exception (9-12). Unfortunately, scientific research concerning Muaythai injury is rare. Multiple weapons used in Muaythai make proper methodological study difficult.

A review of published data for Muaythai (or kickboxing) was found only 6 studies. These revealed a number of trends. Head and lower leg have been shown to be most common sites of injury. The most frequent types of injury recorded were soft tissue and musculoskeletal trauma (12-17). However, the causes of these injuries have not been identified. Three of previous six studies focused on different aspects of Muaythai injury. One was the case report of a spontaneous rupture of an extensor pollicis longus tendon in a kickboxer in 1998 was reported by Loyd et al. (13). The second, reported in the same year, Saengsirisuwan et al. (14) study monitored renal and liver function and muscle injuries during training and after competition in 10 Thai kickboxers aged 14-17 years who had been participating in the sport for at least two years. He reported that, skeletal muscle damage, both during training and competition had no deteriorative effect on liver or renal function. More recently, Buse and Wood (12) identified match-ending injuries in 23 of 74 matches of amateur kickboxing from 1999 to 2001. Of all match-ending injuries, 15 (65.2% from 23 matches) were traumatic brain injury.

The remained three studies determined the rate and type of injuries occurred in Muaythai and kickboxing. Gartland et al. (15) in 2001 and 2005 (17), and Zazryn et al. (16) in 2003 found that head and face were major site of injury (30-50% of all body injuries). Top three of the most common soft tissue trauma and musculoskeletal injury involved contusion, laceration, and abrasion respectively. Research methodology for the investigation of injury rates in Muaythai was imprecise. No information were provided on validation of the questionnaire and the time period for data collection (14-15, 17). Furthermore, the data were collected post-injury, from one on one interview, or secondary sources, which may lead to incomplete or bias data. Importantly, it

was difficult for an athlete to give a complete and accurate description of the injury because of how quickly the injury can occur.

The seriousness and frequency of head and face injuries mean that prevention is of paramount importance (10, 12, 16-22). Establishing and accurate profile of head and face injuries in Muaythai is the first step towards effective prevention measures (23-24). Prospectively video analysis of head and face injuries may reveal the real causes (25-26). Therefore, the main objective of this study was to analyzed head and face injuries sustained from Muaythai weapons by video recording in conjunction with amateur Muaythai injury record form in amateur Muaythai competition held in Thailand.

RESEARCH QUESTIONS

1. What type of Muaythai weapons is the most common cause of head and face injuries in amateur Muaythai boxers?
2. Are there any relationship between external factors (protective gears, weight reduction, etc.) and head and face injuries in amateur Muaythai boxers?
3. What are the types and rates of head and face injuries sustained in amateur Muaythai boxers?

OBJECTIVES

1. To analyze head and face injuries in amateur Muaythai boxers sustained from Muaythai weapons by video recording.
2. To determine relationship between external factors (protective gears, weight reduction, etc.) and head and face injuries by amateur Muaythai injury record form.
3. To investigate the types and rates of head and face injuries sustained in amateur Muaythai boxers.

RESEARCH FRAMEWORK

This is a prospectively observational descriptive research in amateur Muaythai boxers who participated in 3 amateur Muaythai competitions:

1. The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.

2. The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.

3. The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.

This study was accepted by the ethical committee, Faculty of Medicine, Chulalongkorn University, Thailand. All participants had been declared objectives and given written informed consent before participating in this study.

ASSUMPTIONS

1. Two video recorders with mini-DVD recording system (SONY, DCR-DVD605E) were used to simultaneously record all bouts.

2. Amateur Muaythai injury record form was constructed by the researcher, and approved for suitable application by the experts, for data collection.

RESEARCH LIMITATIONS

1. Using only 2 video recorders, some aspect or angle of the moment of injury may be lost.

2. Amateur Muaythai injury record form was recorded by several ringside physicians, which may lead to some discrepancies in the diagnoses.

3. Different referee will stop the bout at different stages, some of which will prevent any serious injury occurring.

4. Only male subjects were studies.

5. The population may be too small when compared to the number of amateur Muaythai boxers in Thailand.

6. The injury pattern may be specific to each amateur Muaythai competition.

OPERATIONAL DEFINITIONS

1. Muaythai is the Muaythai competition that allows fists, feet, knees, and elbows to attack the opponent under the rules and regulations of the art of Muaythai. The boxers must Wai-Kru (pay respect to teacher) before competition. Thai traditional orchestra plays Thai traditional music during Wai-Kru and competition together.

2. Muaythai weapons are methods of apply a fist (punching), a foot (kicking), a knee (kneeing), and an elbow (elbowing) of amateur Muaythai boxers to attack an opponent to gain points during Muaythai competition.

3. Amateur Muaythai boxers are a boxer who contests Muaythai competition. They are Thai nationality, age over 15 year old, and never participated in top 5 standard rings of professional Muaythai competition in Thailand. They must wear protective gears including; head guard, mouth guard, body guard, elbow guards, groin guard, and shin guards during amateur Muaythai competition under the rules and regulations of the amateur Muaythai sport.

4. Head injury is a direct or blunt force attacked to the head by Muaythai weapons during amateur Muaythai competition that resulting in immediately injury to scalp, skull, and/or brain. It has obviously seen during a bout from boxers' gait unsteadiness, respond to stimulations, or nervous system of injured boxers, and may open or closed wound.

5. Face injury is a direct or blunt force attacked to the face by Muaythai weapons during amateur Muaythai competition that resulting in immediately injury to all facial region included open or closed wound beginning with forehead, eyebrows, eyelids, eyes, ears, cheeks, nose, mouth, teethes, tongue, and chin. As well as head injury, it has obviously seen during a bout from injured boxers.

6. Analysis for the causes of head and face injuries in amateur Muaythai boxers with video recorders and amateur Muaythai injuries record form is a method to recognize pictures from video recorded in conjunction with extract data via amateur Muaythai injury record form, both are obtained from amateur Muaythai competition, to distribute and determine causes, types, and rates of head and face injuries in amateur Muaythai boxres resulting from Muaythai weapons (a fist, a foot, a knee, and an elbow).

7. Head guard appropriation is suitable, loose, or ties of amateur Muaythai boxers' head guard that declared by himself, after they had chose their head guard size by themselves and correct wearing it. In addition, it has passed the sliding test and don't obstruct their vision.

EXPECTED BENEFITS AND APPLICATION

1. Understand causes, types, and rates of head and face injuries which occurred during amateur Muaythai competitions.

2. Access the relationships between external factors (protective gears, weight reduction, etc.) and head and face injuries in amateur Muaythai competition.

3. Accumulate knowledge for a proper guideline in amateur Muaythai training techniques to prevent head and face injuries.

4. Primary source data to design amateur Muaythai head guard in both training and competition.

CHAPTER II

LITERATURE REVIEW

RELATED DOCUMENTS AND RESEARCHES

This research was collected all documents and researches that are related to video analysis for the causes of head and face injuries in amateur Muaythai boxers, distributed by list of a topics as follows:

1. History of Muaythai
2. The art of Muaythai weapons application
3. Mae-Mai Muaythai
4. Look-Mai Muaythai
5. Rules and regulations of amateur Muaythai sport
6. Anatomy of head and face
7. Head and face injuries sustained from boxing
8. Related Muaythai injury researches
9. Studies for the causes of sports injuries by video recording

1. History of Muaythai (5-7)

Muaythai is the cultural heritage descended from the ancestors for centuries. Due to long ancient history of Muaythai, lack of evidence recorded, it has been suggest that Muaythai has established together with Thai people. From Sukhothai (1238 in Buddhist era), Ayuthhaya, Thunburi, and Rattanakosin (present) period, Muaythai was practiced for self-defense, health, and profession. In the past, Thailand had numerous wars with the neighbors. Thai males had to practice Muaythai and other weapons to defend the country. Every strategy of survival fighting was used in the war for one purpose - to beat against the opponents. Thus, fists, feet, knees, elbows, and head were applied to fight.

After the wars, Muaythai was regarded as national sport. The competition was usually held in festivals or for entertained the King. Rules and regulations were initially defined. The boxers were required to fight in rounds, each of which lasted until a bored coconut shell sink to the bottom of a container. Each bout had no specific number of rounds. The boxers would fight until one of them yielded.

At present, Muaythai is popular, not only at the professional level but at the amateur level as well. In 1971, Sawaeng Siripile of Srinakarinwiroj University (Physical Education) gave a comment that Muaythai should be generally competed at the amateur level and accepted in the Olympic Games. The amateur Muaythai should set its focus on the wit and style of applying Mauythai techniques to make scores. He therefore prepared Amateur Mauythai Rules and Regulations and held a campus competition among physical education colleges. From then on, amateur Muaythai has gained more popularity.

2. The Art of Muaythai Weapons Application (3-4, 8)

2.1. A fist: apply punching into 15 cherng (methods), as follows:

1) KA JIG KHAI (Straight fist trick).

2) PRAPAI LOM SINGKORN (Straight fist and follow with another rick).

3) WANORN HAK DAN (Swinging fist).

4) PRAKAN PERD LOK (Turns front side fist).

5) KHON NASA (Bent fist).

6) INTRA KWANG JAK (Throws the lengthily fist).

7) PRALAK HAM PON (Uppercuts).

8) PAJON CHANG SAN (Throws the fist and kick together).

9) HANUMAN THAWAI WAEN (A pair of uppercuts).

10) LUAN DAN HERA (Throws a fist and the knee together).

11) NAKA PON FAI KAN (Cross switch fist).

12) HAK DAN LOM KROD (Throws the fist and follows by elbows).

13) ONGKOT KUANG PRAKAN (Twirled fists).

14) RUESEE LUEM YAN (The unreal fists).

15) HANUMAN JONG TANON (Throws the back fist from above).

2.2. A foot: apply kicking into 15 cherng (methods) as follows:

1) PERD TAWAN (Throws the straight kick).

2) LONG DAN PRATOO (Swings back kick).

3) KRATOO KHUA TA (Throws the straight tiptoes).

4) YOTHA SIN THOP (Throws the tiptoes and then kicks).

5) MANOP LEN KHA (Swing back kicks).

6) MATCHA LEN HANG (Kicks in three actions to the three targets: leg, chin, and neck).

7) KWANG LEN PONG (Jumps to throw a kick).

8) NARONG PAYUHABATH (Throws the straight kick and then swings kick).

9) JARAKAE FAD HANG (Swing back kick).

10) GINNAREE LEN NAM (Throws up the heel).

11) TAM DUAY KHANG (Throws the shin).

12) PLANG INSEE (Throws the foot and the fist together).

13) PASHEE SABAT YANG (Cross switch kicks).

14) NANG SALAB BAT (Kicks by changing the feet).

15) KWAD TORANEE (Low-swings-kicks).

2.3. A knee: apply kneeing into 11 cherng (methods) as follows:

1) KUMPAN PUNG HOK (Straight knees).

2) YOK NANG (Swinging-knees).

3) CHUEY KHANG or KAO KOO (2 knees or the flying knees kicks).

4) PRANG SATTROO (Side-knees).

5) NGOO LAI TOOKKAE (Alternately knees).

6) TAKAE TEE CHUD (Throws the knees and then elbows).

7) YOD YOTHA (Throws the knees and the elbows together).

8) POOPA SATAN (The upper-knees).

9) HAK KOR CHANG ERAWAN (Holds the neck and throws the knees).

10) DAN POORA (Throws the knee and the fist together).

11) SILA KRATHOB (Knee-touch).

2.4. An elbow: apply elbowing into 24 cherng (methods) as follows:

1) POONG HOK (Front elbow).

2) SOK FAN NAH (Strobes the front elbow).

3) PRA YAIKAE (Swinging elbow).

4) NGAE LOOK KANG (Straight elbow).

5) THANG PA (Inverted elbow).
6) FA LAN (Protects the elbow with arm).
7) YAN PAYAK (Repeats the elbows).
8) JAK NARAI (Swinging-back elbow).
9) SAI LUEW LANG (Skew-back elbow).
10) KWANG SABAD NA (Shakes elbow).
11) KHACHA TOKMAN (Strikes the swing-back elbow).
12) PASUTHA SATAN (Beats alternately with both elbows).
13) YAN YOTHEE (Presses the elbow back).
14) AKKEE SONG SANG (Throws the elbow and then punch).
15) KAMPANG POOPA (Swinging-back elbow alternately).
16) NAKA KAB HANG (Throws elbows and knees together).
17) CHANG PRASAN NGA (Jumps and elbows).
18) SU DAN NAKA (Throws the elbow to the back).
19) YOTHA KLUEN TAP (Straight elbow).
20) YAN SONG KORN (Throws the elbow to the back).
21) KON TEE THANG (Plant the elbows).
22) KWANG PASUTHA (Throws the swinging-back elbow).
23) RUSEE BOD YA (Throws the straight elbow to neck).
24) NAKA KLUEN GAI (Spiral elbow).

3. Mae-Mai Muaythai (3-4, 7-8)

Mae-Mai Muaythai means the major fighting styles regarded as basic maneuvers in Muaythai fighting. The students have to learn and put them into practice before other trivial techniques or Look-Mai will be taught. Mae-Mai Muaythai is divided into 15 styles as follows:

1. SALAB FUN PLA (The master tricks of Muaythai) - is the main movement or the basic trick used for defensive or to escape from the opponent's straight fist by stepping out the armed-circle lets the fist passed by the face. The attacker throws the straight left fist to the defensive's face and steps the left foot forwards at the same time. For defense, escapes by stepped the right foot obliquely right side 1 step and always the body to the right side about 60 degrees the weight on the right foot, the right leg bent a little, in order to away the head and the

body out and escapes from the attacker's fist. Then pounces on the upper part of the arm with the right hand and catches the attack's wrist with the left hand then turns front wrist up (this action is similar to break the hand).

2. PAKSA WAENG RANG (Defenses in-circle) - is the teacher's trick (or the basic trick) to move in and used another tricks. The attacker throws the straight left fist to the defensive's face then steps the left foot forwards. For defense, stepped hurry forwards oblique to a half of the left side in the opponent's left arm and swaying the body about 60 degrees the weight on the left foot then bent the both arms to counter the upper part and the lower part of the attacker's arm, the both fists close to each other (similar to put the palms of the hands together in salute), the elbows open about 1 span (25 cm), the head and the face are covered by the both arms then glanced towards the opponent's right fist.

3. CHAWA SAD HOK (Elbow out-circle) - is the main basic to escape from the straight fist by stepped out and counter by throwing the elbow. The attacker throws the straight left fist to the defensive's face and steps the left foot forwards. For defense, steps hurriedly, then always the body about 30 degrees to a half of the right, the weight on the right foot, bent the left arm then striked the elbow to the attacker's rib.

4. I NAO THANG GRIT (Elbow in-circle) - is the main basic technique deface the straighten fist and uses the elbow closes to the body in-circle. The attacker throws the straight left fist to the defensive's face then stepped forwards. For defense, steps quickly with the left foot forwards then the body always about 60 degrees to the nearly left side the weight on the left foot, bent the right elbow parallel to the floor and threw it to the attacker's rib.

5. YO KHAO PRASUMERU (Throws the down fist to the chin, bent the body 45 degrees) - used for defense the straight fist by bending the body. Down at close quarters lets the fist passed over the head then threw up the fist to the chin. The attacker throws the straight right fist to the defensive's face and steps with the right foot forwards at the same time. To defense, steps quickly with the left foot and slightly lowers the left knee while the right stays straight, and bends the body down forwards about 45 degrees weight on the left foot, at the same time throws up the right fist under the attacker's chin. Turns the head back to look at the attacker's chin while skill holds the left arm guard up on the front of the chin.

6. TA THEN KAM FAK (Throws the high fist to the chin, bent to body 60 degrees) - is the main basic used for defense the fist to the chin. Technique use to push the

attackers fists away with your arm. The attacker throws the straight left fist to the defensive's face. Steps the left foot forwards at the same time. To defense, steps the left foot of forwards to the half right to the attacker closed quarters, bending the right arm to push the left fists out. Bends the left knees a little and throws up a left fist to the attacker's chin.

7. MON YAN LAK (Defense the fist by throwing the kick) - it is the important master skill. This Mae-Mai used to defense the fists by throwing a kick to the top of the chest or abdomen. The attacker throws the straight left fist and steps the left foot forwards. To defense, always out wards to the right about 45 degrees, the weight on the right foot. Bends the both arms to guard the face, at the same time throws the left foot to the top of the chest of the abdomen of the attacker to push him away.

8. PAK LOOK THOY (Defense the kick with the elbow) - use for defense against the kick by throwing the elbow to the shin. The attacker stands in kicking distance and throws the right kick to the defensive's rib. To defense, bends the body a little and bends the both arm to guard the face. The defensive then always the body to the left then steps the left foot to the back. Bends the right arm and holds up to strike the attacker's kick. While still guarding the face with the left arm

9. JARAKHE FAD HANG (Defense the fist by kick) - used when the opponent throws the fist to the wrong target and loses his balance and then turns the body to kick by swinging the heel back. The attacker throws the straight left fist and steps the left foot forwards. To defense, defensive is quick to jumping with right foot to half right in order to escaped the attacker's fist. Bends the arm to guard the face. Stands on the left foot and turns the body to kick at the abdomen or neck with the right heel.

10. HAK NGUANG AIYARA (Throws the elbow to the thigh) - used for counter the kick by throwing the elbow to the thigh. The attacker throws the right kick to the defensive's rib, bends the both arms to guard the face. The defensive is hurry to stepped the right foot forwards closed to the attacker. Turns the rib to the left, bends the right knee, while the left was straight, then catches the attacker's right foot with left hand and pulls it up, strikes the right elbow to the attacker's ham and holds the attacker's right foot on the high to lost the balance in order to defense the attacker's elbow

11. NAKA BID HANG (Twists the leg and strikes the knee to the calf) - used to defense the kick by catching the tip of the foot. With the both hands and twist it, then throws the

knee to the leg. The attacker throws the right foot to the defensive's rib, bends the arm to guard the face. To defensive is hurry away to the left, the weight on the left foot, grasps the attacker heel with the left hand and grasps the tip of the foot twisted outwards then throws the right knee to the attacker's calf at the same time.

12. VIROON HOK GLAB (To counter the kick by throwing a kick) - used to counter the kick by throwing the heel to the ham. The attacker raises the left foot kick to the defensive's rib. The defensive is quick to throw the left foot to the left ham of the attacker, while holding on the both arms to guard the face. The kicking must do in rapidly and strongly to strike the attacker turned back and lost his balance.

13. DAB CHAWALA (Grapes the fist and throws the fist) - used for defense the straight fist by throwing the fist to the face. The attacker throws the left fist to the defensive's face, steps the left foot forwards and guards the chin with the right arm. The defensive steps the right foot forwards to a half right escape from the attacker's left fist, turns the body to right side. Grabs and pressed down the attacker' left arm and throws the left fist to the face then jumps to a half right side.

14. KHUN YAK JUB LING (Defense-fist-kick-elbow) - is the very important trick use for defense the opponent who is the quickly fighter by throwing the fist, kick and elbow continually. To training is deviled into 3 parts; part 1: the attacker throws the straight left fist to the defensive's face and steps the left foot forwards. The defensive steps the left foot hurriedly forwards close to the attacker' face. Wipes the attacker' left hand out by the right arm. Part 2: the attacker throws the right foot to the defensive's rib. The defensive hurry to away the body to the back estimates half of the left by stepping the left foot. Then ducking to throw the right elbow to the right thigh of the attacker. Part 3: the attacker bends the right arms and throws the elbow to the defensive's head. The defensive quickly bends the arm into his guard to wipe the attacker's elbow and hurries to away the body and step back wards to the back about a half step.

15. HAK KOR ERAWAN (Pulls the neck downs and throws the knee) - is use when the attacker throws the straight left fist and steps the left foot. The defender forwardly towards the attacker and inserts the right arm to grab the attacker' left arm, then jumping to jerk the attacker' neck down and throw the knee to the face.

4. Look-Mai Muaythai (3-4, 7-8)

Look Mai-Muaythai tricks are derived from Mae-Mai Muaythai. Before practicing them, the trainees must have the experience of Mae-Mai Muaythai. It's divided in to 15 styles as follows:

1. ERAWAN SUEY NGA (Throws the fist up to the chin or throws the uppercut to the chin).
2. BATHA LOOB PAK (Grabs the fist and kick to the face).
3. KHUNYAK PA NANG (Parts the fist by throwing).
4. PRARAMA NOW SORN (Cover the elbow and uppercut to the chin).
5. GRAI SORN KHAM HUAI (Escapes from the kick throws the straight kick and strikes the back leg).
6. KWANG LIEW LANG (Follows to kick and strikes with the hell).
7. HIRAN MUAN PAEN DIN (Defends against the kick, rolls on the body and strikes the swinging back elbow).
8. NAK MOOD BADAN (Bends the body ducks under the leg and strikes the knee joint).
9. HANUMAN THAWAI WAEN (Passes to inside and throws the uppercut to the chin).
10. YUAN THOD HAE (Against the trick of kick by kick).
11. THAYAE KHAM SAO (Escapes the kick and back leg).
12. HONG PEEK HAK (Escapes inside and strikes the elbow to the arm).
13. SAK PUANG MALAI (Escapes inside and strikes the elbow to the chest).
14. THEN KWAD LAN (Destroy opponent stability by lower kick after unreal fist).
15. FAN LOOK BUAB (Escapes inside and throws elbow to the face)

5. Rules and Regulations of Amateur Muaythai Sport (27-28)

<u>The Ring</u>

The ring shall be constructed as follows:

1. Size: A square with each side the following dimension: small size 20-feet (6.10 m); large size-24-feet (7.30 m), to be measured within the ropes.

2. Floor and corner: Must be well constructed with no obstructions and with a minimum extension outside the ring of at least 3 feet (91 cm). The minimum floor height should be 4 feet (1.22 m) with a maximum of 5 feet (1.48 m) from the building floor. The corner posts should have a diameter of between four (10.00 cm) to five inches (12.70 cm) with a height of 58 inches (1.47 m) from the ring floor. All four posts must be properly cushioned.

3. Ring floor: The floor must be padded by cushioning, rubber, soft cloth, rubber mat, or similar material with a minimum thickness of 1 inch (2.50 cm) and a maximum of 1.5 inch (3.7 cm). The padding should be completely covered by a canvas cloth.

4. Ropes: Consisting of four ropes with a minimum diameter of 1.20 inches (3 cm) and a maximum of 2 inches (5 cm), stretched and linked to the four corner posts. The distance from the ring floor to the lower rope will be 18 inches (46 cm), to the 2nd rope 30 inches (76 cm), to the 3rd rope 42 inches (107 cm) and the top rope 54 inches (137 cm) respectively. The rope will be covered by a soft or cushioned material. Each rope will be joined together by two strong cords of 1.20-1.60 inches (3-4 cm) diameter and are at equal distance from each other.

5. Ring Steps: at least three (3) sets are required. The width of each step should be at least 3.50 feet (1.07 m). One set is located at each corner and a third shall be positioned centrally for the doctor and other officials.

6. Plastic bin: To be located at the fighter's corner for the disposal of tissues, bandages or any other garbage.

Boxing Gloves

Only gloves certified by World Muay Thai Council (WMC) are allowed to be used in any match.

Boxing glove requirements should correspond to the following weight divisions (Table 2.1.):

Table 2.1. Glove usage by weight division (27).

Weight Division	Glove Weight
Mini Flyweight - Junior Featherweight	6 ounce (132 g)
Featherweight - Welterweight	8 ounce (227 g)
Junior Middleweight and upwards	10 ounce (284 g)

The weight of the leather shall not be more than half of the total glove weight, including the internal cushioning, which should always be in good condition. The laces are to be tied at the back of the wrist band.

To ensure compliance with the regulations, all gloves will be inspected by a member of the match committee prior to the fight.

Bandages

Only a soft material type is allowed, size 2 inches x 6.5 yards (5 cm x 6 m). Plastic or plaster types are strictly prohibited. The use of adhesive tape, size 2.50 cm x 2.50 m is only allowed for covering the back of the wrist and must not be used to cover the knuckles.

Dress

A. Boxer's attire

1. Only boxing shorts are to be worn, the colour of which depending on the corner; red, pink, or maroon or with a red stripe for the red corner; blue, bright blue, black for the blue corner. The dressing gown will be as specified by the World Muay Thai Council (WMC).

2. To ensure the boxer's safety, a groin protector must be worn and tied only at the back.

3. Long hair and/or beards are prohibited. A short moustache is allowed but the hair must not extend over the lip.

4. The Mongkol should be worn when performing the Wai-Kru (pay respect to teacher), prior to the match start. Amulets are only to be worn on the arm or waist and covered by material to avoid injury.

5. Single elastic bandages are allowed to be worn on the arm or legs to prevent sprains, however insertion of a shin guard, etc, is not allowed.

6. No metallized material, decoration or jewellery is allowed to be worn.

7. The use of Vaseline, fat or any similar substance by the boxer to gain unfair advantage is not allowed.

8. Boxer may wear elastic ankle bandages to protect his feet.

B. Any infringement to the dress code may result in the fighter's disqualification. In the case of any problem with the boxing gloves themselves, the referee may temporarily halt the match until they are corrected.

Boxers

Boxer's eligibility:

1. No physical disability and at least 15 years old.
2. Minimum weight: 39 kg.
3. Minimum and maximum age limit:
   3.1. Youth competition is allowed a boxer age range from 15-18 year old.
   3.2. Adult or national competition is allowed a boxer age range from 17-35 year old.

Classification of Weight Divisions

A. Weight Divisions (Table 2.2.)

Table 2.1. Weight divisions (1, 27).

No.	Weight Division	Max. Weight
1.	Paper weight	42 kg
2.	Pin weight	45 kg
3.	Fly weight	51 kg
4.	Bantam weight	54 kg
5.	Feather weight	57 kg
6.	Light weight	60 kg
7.	Light welter weight	63.5 kg
8.	Welter weight	67 kg
9.	Light middle weight	71 kg
10.	Middle weight	75 kg
11.	Light heavy weight	81 kg
12.	Cruiser weight	86 kg
13.	Heavy weight	91 kg
14.	Super heavy weight	91 kg+

B. Weigh-In

1. The boxer shall be weighed without clothes, no later than 3 hours prior to the match.

2. Prior to the weigh-in, all fighters must be examined and certified fit by a licensed doctor.

3. The fighter is allows to official weight-in only one time, but he can conveniently reweigh and check his weight before official weight-in at the test scale machine.

Wai-Kru and Round Definition

Prior to the start of the first round, both fighters shall perform the Wai-Kru (pay respect to teacher), accompanied by the appropriate Thai traditional music, incorporating the Ching (cymbal), Klong khaek (tom-tom) and Pee Java (Thai reed pipe).

An amateur Muaythai bout shall consist of four rounds, 3 minutes per round with a 2 minute break between each round. Any stoppage during the match for any reasons will not be counted as part of the 3 minute round times.

Decision

This should conform to the following rules and regulations:

1. Win by Knock-Out (K.O.) is awarded when opponent is knocked down and unable to continue within the 10 second count.

2. A Technical Knock-Out (T.K.O.) is awarded:

4.1. When a boxer is seriously hurt or weakened.

4.2. When a boxer cannot continue the match after the break.

4.3. On the doctor's recommendation, when the referee is unsure whether a boxer can continue the match due to injury or being seriously weakened.

4.4. Both boxers are seriously injured and cannot continue the match; if less than three rounds: a draw is declared; if three rounds have been reached, individual score decides.

4.5. Receiving a count twice in the same round and unable to continue the match.

3. Win by points.

4. Win by Referee Stopping Contest (R.S.C.) is decided:

4.1. Out-classed (R.S.C.O.) is awarded when the opponent has weak skills than another or attacked one way by another.

4.2. Injury (R.S.C.I) is awarded when the boxer has a poor body condition, can't continue fight, or loose of self defense because serious injury from correct Muaythai weapons in various body location, as follows, injury to the head (R.S.C.H.), injury to the body (R.S.C.B.), injury to the leg (R.S.C.L.), or that may lead to concussion.

5. Win by retirement.

6. Win by walk-over is awarded when the opponent was disappeared before bout but his contest is ready to fight.

Scoring Practice

The standard scoring practice is as follows:

A. A strike either by a punch, foot, knee or elbow.

1. Scoring from a strike:

1.1. Points will be awarded for a correct Muaythai style, combined with hard and accurate strikes.

1.2. Points will be awarded for aggressive and dominating Muaythai skill.

1.3. Points will be awarded for a fighter actively dominating his opponent.

1.4. Points will be awarded for the use of a traditional Thai style of defense and counter-attack.

1.5. Points will be deducted from a boxer who fouls or breaks the rules.

2. Non scoring strikes:

2.1. A strike which is against the rules.

2.2. A strike in defense against the leg or arm of an opponent.

2.3. A weak strike.

B. Fouls

1. The judges will deduct points for any foul as directed by the referee.

2. Any foul observed by the judges but not by the referee, will be penalized accordingly.

Knock down

1. Definition

1.1. Any part of the body touching the floor except the feet.

1.2. Leaning against the ropes in a state of unconsciousness.

1.3. Knocked out of the ring.

1.4. Inability to defend himself.

2. During a count, the referee will direct the opposing boxer to stand in the opposite corner. If he does not, the referee shall stop the count until he does so and then continue. The match will not continue until directed by the referee.

3. The count interval will be at 1 second intervals, from 1 to 10. During the count, the referee will signal, with his hand, to ensure that the boxer receiving the count understands.

4. A boxer on receiving a count cannot continue the match prior to a count of 8 and loses immediately on receiving a count of 10.

5. If both boxers fall down, the referee will direct the count to the last one that fell. If both boxers receive a 10 count, a draw will be declared. Should the boxers lean against each other whilst sitting up, the referee will stop counting at that time.

6. If one of the boxers subsequently falls down again, the referee will continue the count.

7. A boxer not ready to fight again after a break when the bell rings, will receive a count, unless caused by a problem with his attire.

Procedure after Knock-Out

1. If a boxer is knocked unconscious or injured, only the doctor and the referee are allowed in the ring. Any others may only enter at the doctor's discretion.

2. A boxer losing by a K.O. or T.K.O. will be immediately treated and undergo a physical examination by the doctor.

3. Recovery period - after a match, a boxer is required to rest for a minimum of 21 days prior to fighting again, with the following exceptions:

3.1. A winner in the first round is required to rest a minimum of 7 days prior to his next fight.

3.2. The winner in the third round is required to rest a minimum of 14 days prior to his next fight.

3.3. A boxer losing by T.K.O. or K.O. must rest for a minimum of 30 days prior to his next fight.

3.4. A boxer specified under items 3.1.-3.3, must be examined by the doctor at the end of each fight, who will then specify his rest period.

Attendance of certified doctor or ringside physician

1. Perform a physical check of the boxers prior to the weigh-in and certified fit. Prohibited both boxers who have a cut, laceration, contusion on the head and face or serious injuries from fight.
2. Be in attendance during the program until the last fight.

6. Anatomy of Head and Face (29-31)

The head consists of the scalp, skull, brain, face, teethes, cranial nerve, meninges, special sense organ, and other structure such as blood vessels, lymphatics, and fat.

Bone

The skull is composed of twenty-two bones. With the single exception of the mandible, all the bones of the skull are joined together in immovable joints called sutures. The brain is enclosed by the skull, including 8 bones (Figure 2.1.-2.3.) as follows:

1. A frontal bone (1).
2. An ethmoid bone (1).
3. A sphenoid (1).
4. Paired parietal bones (2).
5. Paired temporal bones (2).
6. An ocipital bone (1).

Whereas the facial bone forms the anterior part of the skull containing the orbits and nasal cavities and includes the maxilla and mandible. The facial bone consists of 14 irregular bones (Figure 2.1.-2.3.) as follows:

1. Lacrimal bones (2).
2. Nasal bones (2).

3. Maxillae (2).
4. Zygomatic bones (2).
5. Palatine bones (2).
6. Inferior nasal conchae (2).
7. Mandible (1).
8. Vomer (1).

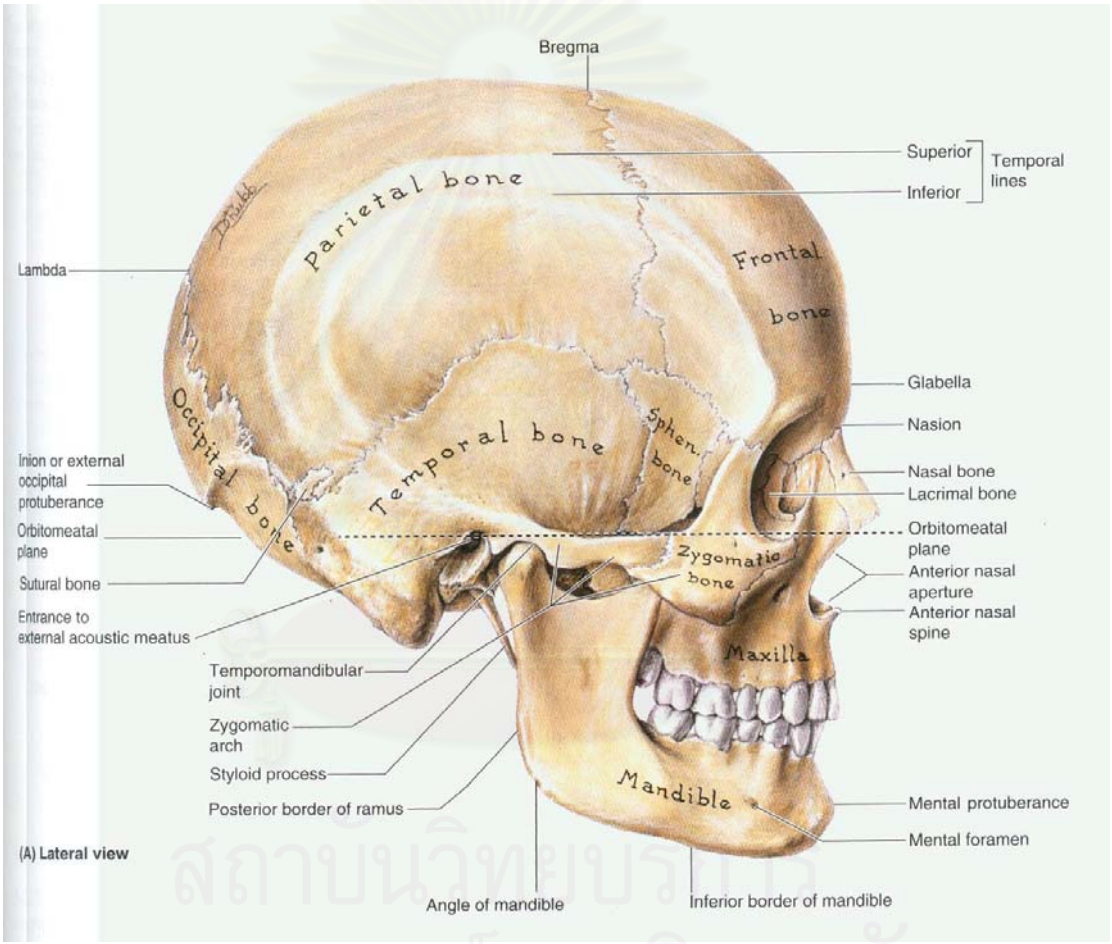

Figure 2.1. Skull and facial bone (Lateral view) (29).

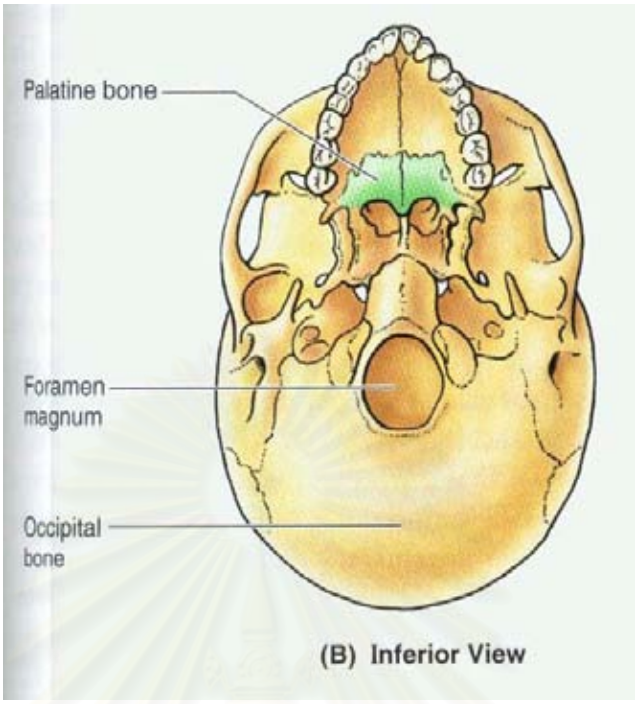

Figure 2.2. Skull and facial bone (Inferior view) (29).

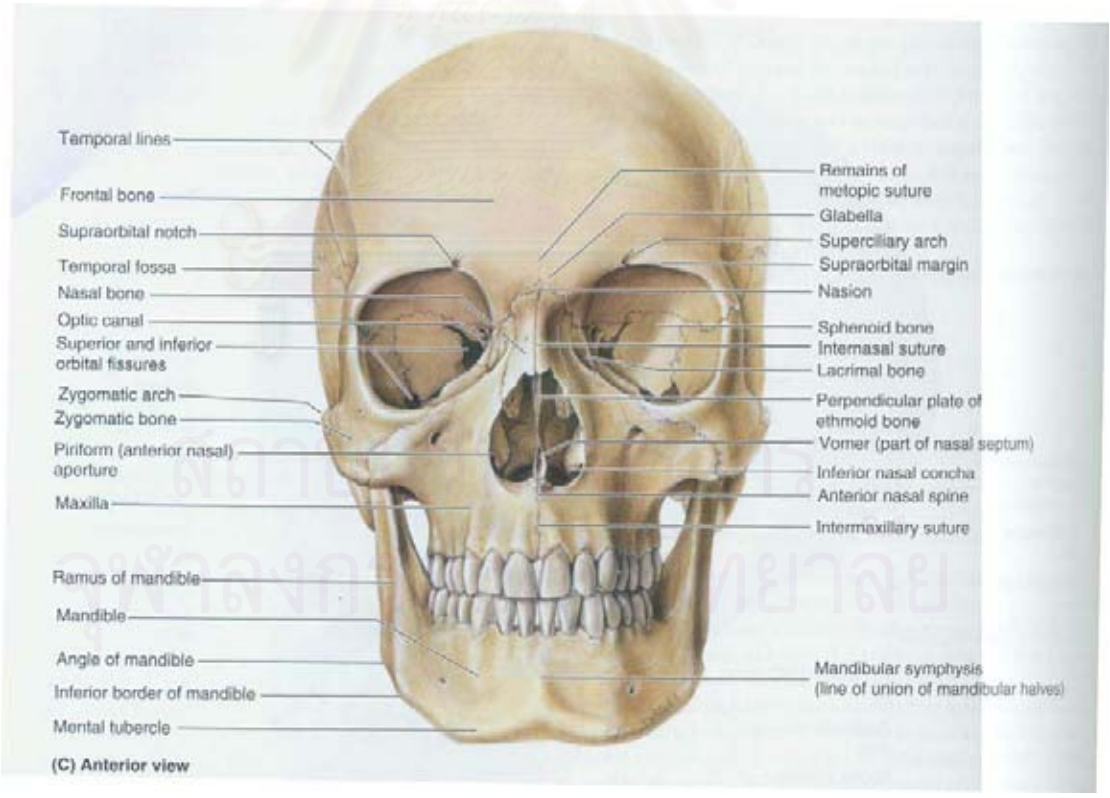

Figure 2.3. Skull and facial bone (Anterior view) (29).

Scalp

The scalp is the covering of the skull. It has five layer of soft tissue. The skin, connective tissue, and aponeurosis epicranalis are three outermost tissue layers. They are fused and move as a single layer. The aponeurosis epicranalis is a thick connective tissue sheet that acts as an attachment for the occipitals and frontalis muscles. Between the first three tissue layers and the periosteum lies a loose connective tissue layer.

Brain

The brain, or encephalon, is the part of the central nervous system that is contained within the bony cavity of the cranium and is divided into four sections. The cerebrum is the largest part of the brain and is divided into two hemispheres that are separated by a deep longitudinal tissue. The cerebrum, also referred to as the cortex, coordinates all voluntary muscle activities and interprets sensory impulse in addition to controlling higher mental functions, including memory, reasoning, intelligence, learning, judgment, and emotions. The cerebellum controls synergistic movement of skeletal muscle and play a critical role in the coordination of voluntary muscle movements. The pons control sleep, posture, respiration, swallowing, and the bladder. The medulla oblongata is the lowest part of the brain stem and regulates heart rate, breathing, and blood pressure as well as coughing, sneezing, and vomiting.

Meninges

Investing the spinal cord and the brain are the meninges, which are the three membranes that protect the brain and the spinal cord. Outermost is the dura mater, consisting of dense, fibrous, and inelastic sheath that encloses the brain and cord. In some places it is attached directly to the vertebral canal, but for the most part, a layer of fat that contains the vital arteries and vein separates the membrane from the bony wall and forms the epidural space. The arachnoid, and extremely delicate sheath, line the dura mater and is attached directly to the spinal cord by many silk like tissue strands. The space between the arachnoid and the pia mater, the membrane that helps contain the spinal fluid, is called the subarachnoid space. The subarachnoid cavity projects upward and running the full length of the spinal cord, connects with the ventricles of the brain. The pia mater is a thin, delicate, and highly vacularized membrane the adheres closely to the spinal cord and to the brain (Figure 2.4.).

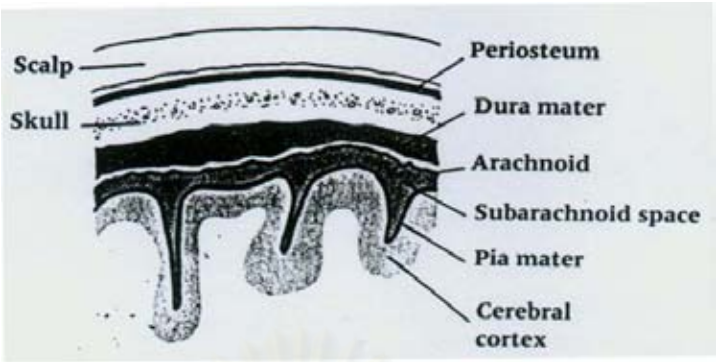

Figure 2.4. The scalp and meningeal membranes covering the brain (31).

Moore and Dalley (30) divided the head into 14 regions (Figure 2.5.), for a clear communications regarding the location of the structures, injuries, or pathologies. The large number of regions into which the relatively small area of the face is divided is a reflection of both its functional complexity and personal importance. Therefore, the head region consists of 6 regions and the facial region consists of 8 regions.

Head Region:

1. Frontal region.
2. Parietal region.
3. Occipital region.
4. Temporal region.
5. Auricular region.
6. Mastoid region.

Facial Region:

7. Orbital region.
8. Infraorbital region.
9. Buccal region.
10. Parotid region.
11. Zygomatic region.
12. Nasal region.
13. Oral region.
14. Mental region.

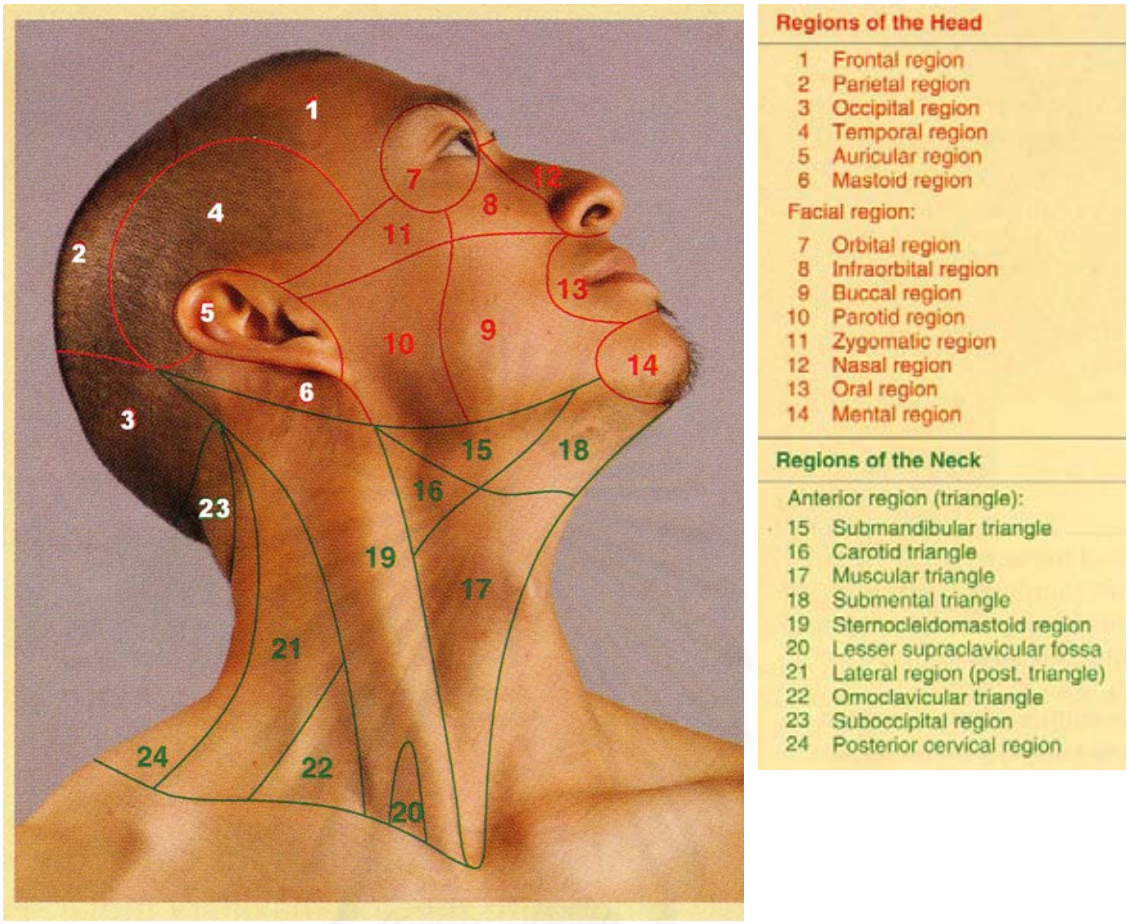

Figure 2.5. Region of the head (30).

7. Head and Face Injuries Sustained from Boxing

Head Injury Definition

There are several meaning of head injury as follows:

Wikipedia (32) stated that head injury was a trauma to the head, which might or might not include to the brain.

From the U.S. National Library of Medicine (33), a head injury was an any trauma that leads to injury of the scalp, skull, or brain. Those injuries can range from a minor bump on the skull to a devastating brain injury.

Booher and Thibodeau (34) presented the term head injury that may used to describe damage to the scalp, skull, or brain. It was important to realized, however, that all three of these structures may not be damaged in any one injury. For example, it was possible for a skull fracture to occur with little or no injury to the scalp or the brain. As a matter of fact, most head injuries occurring in athletics were not associated with a skull fracture.

In accordance with Thompson et al. (cited in 35) a head injury can be defined as any injury to the forehead, scalp, ears, skull, brain and brain stem. Brain injuries are defined as being present in case of a concussion or more serious brain dysfunction, whereas facial injuries are defined as injuries to the area of the face beginning with the eyebrows and extending to the chin, mouth and teeth.

It could be suggested that head injuries was any injuries to the scalp, skull, and brain including injuries to the face and teeth. Those injuries severity can range from a minor bump on the skull to a devastating brain injury.

Type, Severity and Symptoms of Head Injury

Head injury can be classified as 2 major categories as follows:

1. Head injury classified as wound types.
2. Head injury classified as clinical neurological syndromes from boxing.

Each category was described below.

1. Head Injury Categorized as Wound Types (32-33).

A. Closed wound is a blunt force strikes to the head by an object. The head is not bleeding. A concussion is a type of closed head injury that involves the brain.

B. Penetrating or open wound is an injury resulting from an object breaks through the skull and enters the brain.

2. Head Injury Classified as Clinical Neurological Syndromes from Boxing.

A. Acute Head Trauma

The most definitive ending to a boxing match is a knock-out. 8.7% of 547 bouts in the USA National Amateur Boxing Championship were stopped because of knock-outs or head blows. Those are lead to concussion and the latter is the most common acute neurological injury (10). After concussion, there are several syndromes involving an immediate and transient impairment in the ability of the brain to function properly (34). Management of concussion, including determination of when an athlete should return to play, is importance. A subcommittee of the American Medical Association Committee (AMAC) (cited in 34) classified concussion into three degree of severity (Table 2.3.). According to Cantu (cited in 36), guideline for return to play were adapted with severity of concussion via Cantu (22) as Table 2.4. to applied in this study.

Table 2.3. Classification of concussions (AMAC, cited in 34).

Signs and Symptoms	Mild (1 Degree)	Moderate (2 Degree)	Severe (3 Degree)
Consciousness	No loss, stunned, dazed	Transitory loss (up to 5 min)	Prolonged loss (over 5 min)
Confusion	None to momentary	Slight	Severe
Memory loss	None to slight	Mild retrograde amnesia	Prolonged retrograde amnesia
Tinnitus	Mild	Moderate	Severe
Dizziness	Mild	Moderate	Severe
Unsteadiness	Usually none	Varied	Marked

Table 2.4. Severity of concussion. Adapted from Cantu (22, cited in 36).

Grade	Symptoms		Guideline for return to play (with 1st concussion)
	Loss of consciousness	Posttraumatic amnesia	
1 (Mild)	No	1-30 min	When asymptomatic
2 (Moderate)	Less than 5 min	> 30 min to 24 hr	When asymptomatic for 1 week
3 (Severe)	5 min or more	24 hr or more	1 mouth after injury if asymptomatic for 1 week

Amnesia may take the form of 1) retrograde amnesia, in which there is a loss of memory for events that occurred before the injury, or 2) anterograde amnesia, in which there is a loss of memory awakening (34).

Furthermore, Blonstein and Clarke (cited in 10) recognized four categories of knock-out (concussion) severity as follows:

1. No loss of consciousness:
   (a) Type I – hypotomia and defenselessness; dazed.
   (b) Type II – cannot recover before the end of the “10 cont”
2. Loss of consciousness:
   (a) Type I – briefly unconsciousness; quick recovery of faculties.
   (b) Type II – prolonged unconsciousness.

B. Hemorrhage (10, 34)

Intracranial hemorrhaging is a potential life-threatening consequence of a head injury. Hemorrhaging can lead to rapid deterioration of the athlete's condition and must be recognized if death or disability is to be averted. The hemorrhaging forms a hematoma, which may continue to enlarge after the injury. Hematomas are classified by their location within the skull.

1) Subdural Hematoma

Subdural hematoma accounts for as much as 75% of acute brain injuries and the preponderance of boxing-related deaths. They are develops when bridging cerebral vessels that travel from the brain to overlying dura are torn. Hemorrhaging can result in low-pressure venous bleeding or rapid arterial bleeding in to the subdural space. The signs and symptoms of subdural hematoma will vary, depending on the type of hemorrhaging. They may occur in rapid progression or may not be evident for hours or days after the injury.

2) Epidural Hematoma

Epidural Hematomas are much less frequently encountered as sequelae of boxing. It is occurring when a dural artery is ruptured. Usually this hematoma is associated with a skull fracture, and it is commonly caused by a tear of the middle menigeal artery. The bleeding is between the dura mater and the skull. The clot formation is usually rapid, and signs and symptoms may occur in a matter of minutes to hours.

Each of these hematomas can cause an increase in intracranial pressure and shifting of the hemispheres away from the hematoma. This accounts for the deteriorating neurological signs and symptoms, such as a decreasing level of consciousness, loss of movements, slowing of pupil reactions, or dilating pupil.

Failure to evaluate an athlete who suffers a head injury for neurological signs that may indicate hemorrhaging and expanding lesion within the cranium can result in death or disability for the athlete.

C. Boxer's Encephalopathy (10)

Pugilistic traumatic encephalopathy is a well-established entity or "Punch Drunk Syndrome". The encephalopathy is most common among second-rate fighters, and particularly those used extensively as sparring partners. Such individuals may enter amnestic

states and/or be knocked out several times a day. As well as boxers who don't have competed rest from closed head injury and sustained injury again. LaCava (cited in 10) described a three-stage evolutionary process that typically follows the reversible prodrome of vertigo, ataxia, headache and amnesia, if the boxer continues boxing.

Stage 1 is variably reversible. It is hallmarked by euphoria and hypomania (a 'Mr Hyde' syndrome but without a loss of judgement). Gross motor functions remain intact but rope skipping, punch accuracy and intricate motor skills are impaired.

Stage 2, the hypomania is replaced by arrogance, irritability and a chauvinistic paranoia often related to impotence. A chronic amnestic state, resting tremor and shuffling gait, dysarthria and garbled speech are frequent findings.

Stage 3 typically appears a few years after the encephalopathic prodome. Mentation slows, cognitive functions are impaired, hyperreflexia and mask-like facies herald the presence of both pyramidal and extrapyramidal disorders. A progression of psychiatric and neuromotor manifestations may be present at independent rates.

Ross et al. (cited in 10) essentially regard the neurological consequences of boxing to be a direct correlate of the number of bouts fought (particularly among professionals). Their general perceptions are summarized in Table 2.5.

Table 2.5. Neurological sequelae in professional boxers (10).

Number of bouts	Expectation
20-30	None or subclinical evidence of brain injury
25-50	No clinical dysfunction detectable but frequency computerized tomography (CT) and/or neuropsychological test abnormalities
> 50	Many with clinical signs/symptoms of brain injury and CT and/or neuropsychological test abnormalities

Face Injury (10, 34)

1. Soft Tissue Injury

Common facial injures are contusion, abrasion, and lacerations of the skin. These locations (Figure 2.6.) and some cuts mandate the termination of the bout. However, cut in or about the region labeled A in Figure 2.6. are innocuous (don't serious).

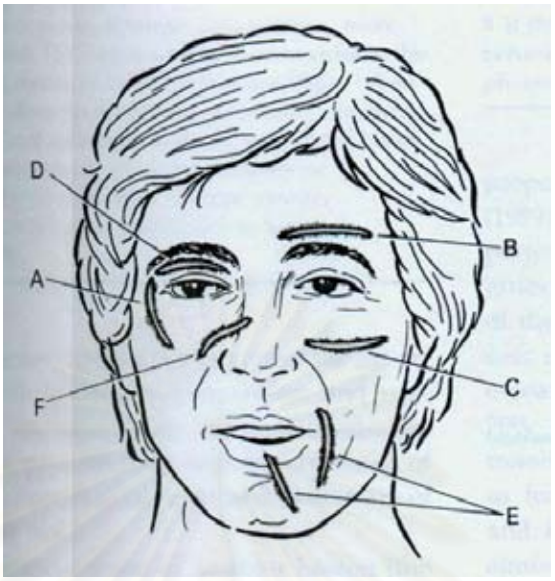

Figure 2.6. Common cut and laceration in a face from boxing (10).

For an explanation of A-E, see Table 2.6.

Cuts labeled B-E are “fight-stoppers” and F is a potential fight-stopper for reasons indicated in Table 2.6.

Table 2.6. Fight-stopping lacerations. Adapted from Minkoff (10).

Letter in Figure 2.6.	Reason to stop the bout
A	Innocuous
B	May jeopardize the supraorbital nerve
C	May extend to infraorbital nerve of nasolacrimal duct
D	May damage the tarsal plate
E	Vermillion border tears may extend and predispose to later tears with trauma
F	Stop if underlying nasal fracture

2. Fractures of the Mandible

Fractures to the mandible are more common than fractures to the maxilla or dislocations of the temporomandibular joint. However, fractures of the mandible are not common in boxing. The frequency of fractures of the mandible is indicated in Figure 2.7.

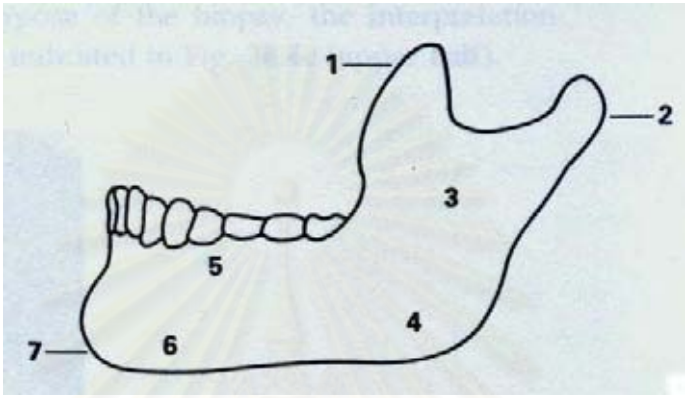

Figure 2.7. Distribution and frequency of mandibular fractures in boxing (10).
1) coronoid process (2%), 2) condylar process (35%), 3) ramus (4%), 4) angle (20%),
5) alveolar process (4%), 6) body (20%), 7) symphysis (14%).

3. Nasal Fractures (34)

The two nasal bones are the most frequently fractures bones in the face. Nasal fractures often occur with a bleeding together. It is best to evaluate the nose as soon after injury as possible. Swelling is likely to occur, and once the area becomes swollen, important signs indicating a nasal fracture may be masked.

4. Epistaxis (Nosebleeds) (34)

Hemorrhage from the nose is common in boxer facial injuries. Nosebleeds rarely become serious enough to jeopardize the lift of the boxer. Because the nasal cavity is a bony space, even serious hemorrhage usually can be controlled by packing the cavity with gauze or cotton and applying pressure to the nostril of the bleeding side.

Boxing-Related Deaths and Head Injury

Injury to the brain is the most frequent fatal catastrophic sports injury. As brain is incapable of regeneration, an injury to this organ is singularly important (22).

Calculating the fatality rate for boxing is imprecise because the exact number of amateur and professional boxers in the world is unknown. However, Cantu (19) reported fatality rate for boxing as 0.13 death per 1,000 participants. When compare with other sports during the same period, using fatality rates per 1,000 participants, boxing was eighth on the list of hazardous sports and was below horse racing (jockeys and sulky drivers), 12.8; sky diving, 12.3; hang gliding, 5.5; mountaineering, 5.1; scuba diving, 1.1; motor racing, 0.7; and college football, 0.3 (19).

From January, 1918 to June, 1983, 645 fatalities (average 9.9 of deaths per annum) were recorded worldwide, most in professional boxing. From January, 1970 to December, 1985, there were 28 deaths (average 4.0 of deaths per annum), suggesting a decreasing trend in the number of fatalities (10, 22).

It has been suggest that most boxing fatality was a consequence of head injury. From a study by New York State Athletic Commission of acute boxing injuries suffered in the professional ring in New York from August 1, 1982, to July 1, 1984, and reported by Jordan and Cambell (cited in 18), identified 377 that occurred in 3,110 rounds of boxing. Of these, 262 were described as injuries to the head other than laceration and eye injuries, of which there were 8. Four of these fighters required hospitalization, and 1 of them died. Two, not necessarily of those who were hospitalized, suffered from a postconcussion syndrome (hemorrhage). According with Jedlinski et al. (cited in 18), he studied 60 amateur Polish boxers who had more than 100 bouts. Thirty-three (55%) showed positive neurologic signs, although frank encephalopathy was manifested in thirteen (21.7%), and severe damage, including dementia, was found in five (8.4%).

Furthermore, clinical examination of former boxers, including neurological, radiological, and electroencephalographic testing, and postmortem examination of some former boxers' brains, indicated a relatively high occurrence in chronic brain damage, often associated with serious behavior disorders, chronic mental and physical disability, and perhaps decreased longevity (18).

8. Related Muaythai Injury Researches

Very little was known to Muaythai (or kickboxing) injuries. From 1998 to 2006, 6 studies were related in Muaythai injuries. First, Loyd et al. (13) reported a case of a 23 year old male kickboxer who had spontaneous rupture of an extensor pollicis longus tendon. He suggested

that the cause of the tendon rupture was direct pressure on the dorsal tubercle of the radius sustained while performing reverse press ups.

Saengsirisuwan et al. (14) monitored renal and liver functions and muscle injuries during training and after Thai kickboxing. Twenty male adolescents aged 14 to 17 years were enrolled to the study. The subjects were divided into two groups: controls and boxers. The control subjects consisted of ten sedentary youths who did not play any sports regularly; the boxers were ten young professional Thai boxers, from the Sor-Phloenchit boxing stable, who had competed in boxing matches for at least two years. Blood samples were withdrawn by venipuncture from the boxers. Urine specimens were obtained as well as blood samples, before and after intensive training and 12 hours after a match. He found that, during training and competition, Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) were not significantly increased. The result shown that, neither renal nor liver function was deleterious as the result of training or competition, whereas Creatine Kinase (CK), CK-MB, and Lactate Dehydrogenase (LDH) significantly increased. It might be concluded that, skeletal muscle cell were damaged during training and competition. However, information on frequency of data collection was not obtained.

Since 1999 to 2001, Buse and Wood (12) identified match-ending injuries in amateur kickboxing among military and civilian competitors. A total of 148 military competitor from U.S. Air Force and Marine Corp. were participated in the matches (N = 74) from September 1999 to March 2001. Match-ending injuries were observed and managed from ringside by the author. Competitors' ages ranged from 15 to 42 years, with 124 male competitors competing in 62 matches and 24 female competitors competing in 12 matches. Off all matches, 23 (31.1%) were stopped because of injury. Most common injury (15 matches, 65.2%) ended because of traumatic brain injury. 12 matches were male (19.4%), 3 matches were female (25.0%). Second common injury (4 matches, 17.4%) ended because orthopedic trauma. It has been suggested that if a boxer sustained head injury, a referee should stop the match. Unfortunately, the causes of match-ending injury were not identified.

At present, only three studies investigated the injury rate in Muaythai (or kickboxing). Gartland et al. (15), in 2001, performed one on one interview using a standard questionnaire, devised with advice from a senior instructor at Muay Thai Center of Excellence in Manchester, to determine the type and rate of injuries that occur during the training and practice

of Muaythai kick boxing. The questionnaire was gathering information consist of age, sex, training hours, level of contact (none, touch sparring, full contact, and competition), level of playing (beginner, amateur, and professional), as well as previous injuries in last 6 and 12 months. Interviews were conducted at various gyms and competitions in the U.K. and at Muay Thai Gala in the Netherlands in 2001. The median age was 26 years (range 14-51) with has training range from 1 to 30 years. There were 51 professionals, 82 amateurs, and 19 beginners. Head injuries were second most common in professionals (42.5%) and amateurs (31.0%). The annual injury rates included soft tissue injuries, were 21.3 injuries per 1,000 participants per years in professionals, 7.1 injuries per 1,000 participants per years in amateurs, and 59.3 injuries per 1,000 participants per years in beginners.

Nevertheless, if contusion, superficial laceration, and haematomas were not included because the author claimed that there was inaccurate reporting of these, then the annual injury rates was reduced in those 3 levels of playing (2.79, 2.43, and 13.5 injuries per 1,000 participants per years in professionals, amateurs, and beginners respectively). Soft tissue trauma was most common type of injury in the 3 groups (92.1%, 87.3%, and 79.1% in professionals, amateurs, and beginners respectively).

It is a concern that the annual injury rate was obtained by indirect calculation. The injury rate will be more accurate if corrected directly, for example, investigation of the incidence of injury in 1,000 participants to obtained the injury rate per 1,000. Moreover, no information was provided on validation of the questionnaire or the time period for data collection. Many subjects were unclear as to what an injury was and saw them only as something sever or debilitating. These may result in recall bias, diminished the accuracy of the information needed to understand the cause of injury.

Zazryn et al. (16) determined the rate and type of injuries occurring in 3,481 fight participations in kickboxing. He retrospective statistical described the results of all Victorian fights participated in by Victorian registered kickboxing contestants during August 1985 to August 2001 from Victorian Professional Boxing and Combat Sports Board. A total of 382 injuries were recorded, at an injury rate of 109.7 injuries per 1,000 fight participations. The most common body region injured was the head/neck/face (51.6%) at rate of injury per 1,000 fight participations of 56.6. Almost two thirds (62.9%) of the fight participations in which contestants were injured resulted in a loss to the contestant. The most common type of injuries was

superficial (including bruising and blistering) which occurred at a rate of 43.4 injuries per 1,000 fight participations or 39.5% of all injuries.

As with Gartland et al. (15) this one has weaknesses. The results were indirect recorded. We couldn't confirm that the result were preciseness because the injury time was shortly and rapidly occurring. The validity and reliability of the recording was unclear. Subsequently, few injuries go unrecorded and as such are missed.

To overmaster defect of previous retrospective studies, Gartland et al. (17), in 2005, attended amateur Muaythai competitions in the U.K. Injuries were recorded as those referred by the referee or participant to the on-site medics. There were 92 participants, 12 females and 80 males. The average age was 17.3 years. A total of 588.5 minutes of competition time was assessed during a total of 10 events. The most injures was occurring in heavy weight, 175.1 lb, as an injury rate of 30 injuries per 100 minutes of competition in their own weight category. The head injuries consist of epistaxis, head laceration, and concussion was most occurring (10 cases from all 15 cases) in all weight categories. 4 cases was K.O. but there were no information of body site injured. Remained 1 case was leg contusion.

It should be noted that result of Gartland et al. (17) dose not provide information on period of those amateur Muaythai competitions was held. Focusing on injuries exposure, 15 cases were slight cases when compare with previous studies (12, 14-16). This might be resulting from inappropriate methodology of data collection. It is important that as more modification as possible about the methodology in which the injury was sustained from. When the cause was identified and the prevention was established, the injury would decrease.

9. Studies for the Causes of Sports Injuries by Video Recording

Because of limitation, accuracy, and reliable of previous studies in head and face injuries in amateur Muaythai boxers weren't confirmed the actually injuries. The causes of head and face injuries wouldn't be established yet. Prospective video recording in the amateur Muaythai competition is another way to be performed.

In 2002, Koh et al. (25) investigated the fighting conditions under which blows to the head commonly take place, with a video analysis to determining the typical condition under which injury may occur. The semi-final and final matches (a total of 48 matches) at the 14th World Taekwondo Championships in 1999 was choosing. He can identified frequency of head

blows by weight class; observed features (direct contact of the head region, head displacement postimpact, fail postimpact, gait unsteadiness, loss of consciousness, knocked-down, stunned or dazed, single head blows, and multiple head blows); and technique (Axe kick, roundhouse kick, turning-roundhouse kick, spinning kick, and back kick). Also, leading situation of head blow by attacker and receiver action and sparring stance were identified. Based on inclusion and exclusion criteria, a total of 35 incidences of head blows occurred (365 blows per 1,000 athlete exposures). All of these head blows were associated with a direct head of face contact and frequency (35%) involved: a closed sparring stance (65.7%), shorter athlete, axe or roundhouse kick (51.4%), attacker's offensive kick and head-blow-receiver's offensive action with absence of a blocking skill (51.4%).

Andersen et al. (26) described the injury mechanisms for ankle injuries in male elite football. Videotapes and injury information were collected for 313 of 409 matches from Norwegian and Icelandic elite football during the 1999 to 2000 seasons. Video recordings of incidents that resulted in ankle injuries were analyzed and cross-referenced with injury reports from the team medical staff. A total 46 acute ankle injuries were reported to have occurred, that is, 4.5 injuries per 1,000 match hours. Of these, 26 (57%) were identified on the videotapes. Two mechanisms thought to be specific to football were found: 1) player-to-player contact with impact by an opponent on the medial aspect of the leg just before or at foot strike, resulting in a laterally directed force causing the player to land with the ankle in a vulnerable, inverted position; and 2) forced plantar flexion where the injured player hit the opponent's foot when attempting to shoot or clear the ball.

Therefore, it has been suggest that systematic video analysis provides detailed information on the rates, types, and mechanisms of injury. If using video analysis in conjunction with injury record form to identify prospective incidence of injury, especially amateur Muaythai correlated with high injury to the head and face, the real causes of sports injury could be reveal.

CHAPTER III

MATERIALS AND METHODS

POPULATION

Target population was amateur Muaythai boxers in Thailand. Study population was amateur Muaythai boxers participated in amateur Muaythai competitions between September, 2006 and April, 2007.

The sample was amateur Muaythai boxers who participated in amateur Muaythai competitions as follows: 1) The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand. 2) The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand. And 3) The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand. Overall sample was 341 boxers.

Inclusion Criteria

1. A boxer who has participated in one of the 3 amateur Muaythai competitions including:
   - The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.
   - The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.
   - The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.
2. A boxer who was examined by a physician not to have sustained head and face injuries immediately prior to the bout.
3. A boxer who actually competed in the competition.

Exclusion Criteria

1. After a boxer had weighted-in and medical checked up by certificated doctor, he has either head or face injuries prior to amateur Muaythai competition.

OBSERVATION AND MEASUREMENT

Independent Factors

1. Muaythai weapons (a fist, a foot, a knee, and an elbow).
2. Head guard appropriation.
3. Head guard sliding.
4. Elbow guard sliding.
5. Weight reduction.

Dependent Factors

1. Frequency of head and face injuries.
2. Site of head and face injuries.
3. Type of head and face injuries.
4. Severity of head and face injuries.
5. Round of head and face injuries.
6. Competition stage of head and face injuries.

Criteria for Measurement

1. Recorded of head and face injuries via amateur Muaythai injury record form.
2. Clear observation of head and face injuries during a bout.
3. The boxer demonstrated a stunned, dazed, gait unsteadiness, or fall after had head and face blown.
4. The referee called standing count (usually 8-count) because the boxer had head and face blown.
5. The referee stop bout and called ringside physician to treated the boxer who had head and face injuries.
6. The boxer who decided to lost both by the referee and ringside physician because head and face injuries.

METERIALS

Tools

1. Video records in amateur Muaythai competitions.

2. The amateur Muaythai injury record form (Appendix A, pp.63) had constructed by researcher and approved for appropriated application by the experts (Appendix B, pp.64) for data collection. It consist of 3 parts as follows:

2.1. Part 1 Medical check up; is the recorded data of physical examination of amateur Muaythai boxers by certificated doctor or ring side physician. For example; age, weight, body temperature, resting heart rate, blood pressure.

2.2. Part 2 Questionnaire and head guard sliding test; is amateur Muaythai boxers' interviewing of external factors associated with head and face injuries such as; Muaythai experienced, Muaythai weapons domination, weight reduction, physical and mental readiness, and head guard appropriation.

2.3. Part 3 Injuries record; consists of, for example, round of injuries exposure, injuries site, injuries type, severity of injuries, and etc. Ringside physician have responsibility to complete this part.

Equipments

1. Video recorder with mini-DVD recording system (SONY, DCR-DVD605E) and its accessories.

2. A mini double video disc (mini-DVD) and compact disc (CD).

3. Video recorder set up equipments; including tripod legs, plastic sheet, marker, tape measure, and moveable table.

4. A mini-DVD marker and mini-DVD case.

5. Digital camera (PENTAX, M20).

6. Computer with SPSS version 14.0 and Dartfish version 4.0 software.

Figure 3.1. Video recorder with mini-DVD recording system (SONY, DCR-DVD605E).

DATA COLLECTION

1. All of head and face injuries resulting from Muaythai weapons in 3 amateur Muaythai competitions, as previously, were collected.

2. Every round during amateur Muaythai competitions was recorded with DVD recording system. Two video recorders were simultaneously used by researcher and assistant researcher. The first camera was set up parallel to one side of the boxing ring, range of 5-10 m, depending on variously suitable ring locations. This camera recorded all action in the ring.

The second camera was used by the researcher to closely monitored boxing actions especially injuries. Importantly, both video cameras must not obstruct the competition or disturbed the boxer.

3. Ringside physicians were requested to complete the amateur Muaythai injury record form in part 1 and part 3. Part 1 was recorded in the morning during medical check up prior to each boxer's bout. Part 3 was recorded during each bout in the afternoon. However, ringside physician had been informed the objectives and how to recognize head and face injuries in a couple of days before the first weigh-in day.

4. Prior to the medical check up, boxers were asked to participate in this study. The information sheet and instruction (Appendix C, pp.65) was distributed. If they accepted to participated, they had written informed consent in the consent form (Appendix D, pp.66).

Subsequently, the researcher interviewed boxers and test the head guard appropriation. The result was recorded in part 2 of the amateur Muaythai injury record form.

5. The competition data including the master program, day by day program, number of weight category, number of boxers, number of bouts, and number of rounds were collected from the Organizing committee of each competition. Favorite guarding of all boxers were obtained by video records reviewing. These data were further source for analysis of the causes of head and face injuries.

6. Head and face injuries ascertained by criteria for measurement from both video records (after encoded to digital files) and the amateur Muaythai injury record form were choose. In Dartfish version 4.0, each appropriate digital file was selected beginning with attacker use of Muaythai weapon, impacted on the opponent, until injury occurred. Then, frame by frame slow motion playing will reveal the causes of head and face injuries. Furthermore, head guard sliding and elbow guard sliding in each case of injuries were detected.

To ensure the unity of injury and reduce bias from vary ringside physicians diagnosis, those chosen digital files were reviewed by an experienced ringside physician who most experienced in this duty and confirmed again with the amateur Muaythai injury record form.

DATA ANALYSIS

1. All data were calculated in summary, mean, standard deviation (SD.), and percentage.

2. Chi-Square (χ^2) with test for homogeneity was used to test difference between Muaythai weapons and occurrences of head and face injuries. Injury rate was calculated as injury rate per 1,000 rounds.

3. Student unpaired t-test was used to test difference of general characteristics between injured and non injured boxers.

4. Relative risk and Chi-Square (χ^2) with test for association were used to identify the level of relationship between external factors (not Muaythai weapons) and head and face injuries.

5. The significance level was set at .05 with decision of confident interval at 95% (95% CI). SPSS version 14.0 was the statistical software to be used.

CHAPTER IV

RESULTS

ANALYZED RESULTS

Video recorded from amateur Muaythai competition were 290 bouts or 907 rounds. There were 341 male amateur Muaythai boxers. There were 30 cases of head and face injuries (Appendix E-F, pp.67-70). Data analysis by using Dartfish version 4.0 and SPSS version 14.0 revealed the results as follow.

Table 4.1. General characteristics of the subjects (n=341).

General characteristics		Mean (SD.)	Total (Percentage)
1. Age (year)		18.22 (2.48)	-
2. Weight (kg)		56.07 (8.19)	-
3. Height (cm)		167.18 (6.27)	-
4. Resting heart rate (bpm)		76.44 (12.29)	-
5. Blood pressure	- systolic (mm.Hg)	112.77 (11.58)	-
	- diastolic (mm.Hg)	67.50 (8.74)	-
6. Muaythai experienced (year)		3.52 (2.76)	-
7. Weight reduction (kg)		0.95 (1.34)	-
8. Physical readiness	- ready	-	341
	- not ready	-	0
9. Mental readiness	- ready	-	341
	- not ready	-	0
10. Favorite guarding	- left	-	327 (95.9)
	- right	-	14 (4.1)
11. Muaythai weapons domination			
	- fist	-	45 (13.2)
	- foot	-	224 (65.7)
	- knee	-	60 (17.6)
	- elbow	-	12 (3.5)

Table 4.2. Frequency of head and face injuries from Muaythai weapons in amateur Muaythai boxers by injury site (907 rounds) (n=341).

Head and face injuries	Fist		Foot		Knee		Elbow		Total	
	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds
Injury site										
- Brain	13 (72.2)	14.3	7 (87.5)	7.7	1 (50.0)	1.1	2 (100.0)	2.2	23 (76.7)	25.4
- Left eyebrow	-	-	-	-	1 (50.0)	1.1	-	-	1 (3.3)	1.1
- Left eyelid	2 (11.1)	2.2	-	-	-	-	-	-	2 (6.7)	2.2
- Left cheek	-	-	1 (12.5)	1.1	-	-	-	-	1 (3.3)	1.1
- Nose	3 (16.7)	3.3	-	-	-	-	-	-	3 (10.0)	3.3
Total	18 (100.0)	19.8	8 (100.0)	8.8	2 (100.0)	2.2	2 (100.0)	2.2	30 (100.0)	33.1
Difference (χ^2)	20.580									
p-value	.057									

Table 4.2. shows that, a fist was most common cause of brain injury, follows by a foot, an elbow, and a knee respectively. Brain was the most common injury site. However, injury site resulting from Muaythai weapons has no statistical significance difference.

Table 4.3. Frequency of head and face injuries from Muaythai weapons in amateur Muaythai boxers by injury type (907 rounds) (n=341).

Head and face injuries	Fist		Foot		Knee		Elbow		Total	
	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds
Injury type										
- Concussion	13 (72.2)	14.3	7 (87.5)	7.7	1 (50.0)	1.1	2 (100.0)	2.2	23 (76.7)	25.4
- Open Wound	1 (5.6)	1.1	-	-	1 (50.0)	1.1	-	-	2 (6.7)	2.2
- Abrasion/Graze	1 (5.6)	1.1	-	-	-	-	-	-	1 (3.3)	1.1
- Contusion	-	-	1 (12.5)	1.1	-	-	-	-	1 (3.3)	1.1
- Epistaxis	3 (16.7)	3.3	-	-	-	-	-	-	3 (10.0)	3.3
Total	18 (100.0)	19.8	8 (100.0)	8.8	2 (100.0)	2.2	2 (100.0)	2.2	30 (100.0)	33.1
Difference (χ^2)	12.246									
p-value	.426									

Table 4.3. shows that, a fist was most common cause of concussion, follows by a foot, an elbow, and a knee respectively. Concussion was the most common injury type. However, injury type resulting from Muaythai weapon has no statistical significance difference.

Table 4.4. Frequency of head and face injuries from Muaythai weapons in amateur Muaythai boxers by severity of injury (907 rounds) (n=341).

Head and face injuries	Fist		Foot		Knee		Elbow		Total	
	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds
Severity of injury										
- Not rest (epistaxis)	3 (16.7)	3.3	-	-	-	-	-	-	3 (10.0)	3.3
- Not rest (grade 1 concussion)	10 (56.6)	11.0	6 (75.0)	6.6	1 (50.0)	1.1	2 (100.0)	2.2	19 (63.3)	20.9
- Rest 1-3 days	1 (5.6)	1.1	1 (12.5)	1.1	-	-	-	-	2 (6.7)	2.2
- Rest 4-7 days (grade 2 concussion)	3 (16.7)	3.3	1 (12.5)	1.1	-	-	-	-	4 (13.3)	4.4
- Rest 1-4 weeks	1 (5.6)	1.1	-	-	1 (50.0)	1.1	-	-	2 (6.7)	2.2
Total	18 (100.0)	19.8	8 (100.0)	8.8	2 (100.0)	2.2	2 (100.0)	2.2	30 (100.0)	33.1
Difference (χ^2)	10.554									
p-value	.568									

Table 4.4. shows that, a fist was most common cause of grade 1 concussion (not rest), follows by a foot, an elbow, and a knee respectively. Not resting of a boxer (from grade 1 concussion) was the most common severity of injuries. However, severity of injury resulting from Muaythai weapons has no statistical significance difference.

Table 4.5. Frequency of head and face injuries from Muaythai weapons in amateur Muaythai boxers by round (907 rounds) (n=341).

Head and face injuries	Fist		Foot		Knee		Elbow		Total	
	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds
Round										
- 1st Round	5 (27.8)	5.5	5 (62.5)	5.5	2 (100.0)	2.2	-	-	12 (40.0)	13.2
- 2nd Round	5 (27.8)	5.5	3 (37.5)	3.3	-	-	2 (100.0)	2.2	10 (33.3)	11.0
- 3rd Round	6 (33.3)	6.6	-	-	-	-	-	-	6 (20.0)	6.6
- 4th Round	2 (11.1)	2.2	-	-	-	-	-	-	2 (6.7)	2.2
Total	18 (100.0)	19.8	8 (100.0)	8.8	2 (100.0)	2.2	2 (100.0)	2.2	30 (100.0)	33.1
Difference (χ^2)	13.160									
p-value	.156									

Table 4.5. shows that, a fist was fist common cause of injuries in 3rd round. A foot was second common cause of injuries in 1st round. A knee and an elbow was common cause of injuries in 1st and 2nd round respectively. The 1st round was the most injuries round. However, injury round resulting from Muaythai weapons has no statistical significance difference.

Table 4.6. Frequency of head and face injuries from Muaythai weapons in amateur Muaythai boxers by competition stage (907 rounds) (n=341).

Head and face injuries	Fist		Foot		Knee		Elbow		Total	
	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds	Number (Percentage)	Injury rate per 1,000 rounds
Competition stage										
- First	9 (50.0)	9.9	5 (62.5)	5.5	2 (100.0)	2.2	1 (50.0)	1.1	17 (56.7)	18.7
- First, bronze	1 (5.6)	1.1	-	-	-	-	-	-	1 (3.3)	1.1
- Second	5 (27.8)	5.5	1 (12.5)	1.1	-	-	1 (50.0)	1.1	7 (23.3)	7.7
- Bronze	1 (5.6)	1.1	-	-	-	-	-	-	1 (3.3)	1.1
- Semi-final	1 (5.6)	1.1	1 (12.5)	1.1	-	-	-	-	2 (6.7)	2.2
- Final	1 (5.6)	1.1	1 (12.5)	1.1	-	-	-	-	2 (6.7)	2.2
Total	18 (100.0)	19.8	8 (100.0)	8.8	2 (100.0)	2.2	2 (100.0)	2.2	30 (100.0)	33.1
Difference (χ^2)	5.249									
p-value	.990									

Table 4.6. shows that, a fist was most common cause of injuries in first stage, follows by a foot, a knee, and an elbow respectively. Most injuries were occurred in first stage. However, competition stage of injury resulting from Muaythai weapons has no statistical significance difference.

RESULTS OF FACTOR ANALYSIS

Relationship between external factors and head and face injuries was calculated by using SPSS version 14.0. The results are shown in table 4.7. to table 4.11. as follow.

Table 4.7. General characteristics of injured and non injured boxers (n=341). Data was shown as mean (SD. or percentage).

General characteristics		30 injured boxers	311 non injured boxers	p-value
1. Age (year)		18.73 (2.54)	18.17 (2.48)	.785
2. Weight (kg)		59.35 (7.94)	55.75 (8.16)	.583
3. Height (cm)		169.75 (5.55)	166.95 (6.31)	.227
4. Resting heart rate (bpm)		80.27 (12.71)	76.07 (12.21)	.624
5. Blood pressure	- systolic (mm.Hg)	114.28 (8.93)	112.63 (11.81)	.128
	- diastolic (mm.Hg)	70.30 (6.30)	67.23 (8.91)	.287
6. Muaythai experienced (year)		4.57 (3.59)	3.42 (2.69)	.055
7. Weight reduction (kg)		1.60 (1.81)	0.89 (1.27)	.001
8. Physical readiness	- ready	30 (8.79)	311 (91.21)	-
	- not ready	-	-	-
9. Mental readiness	- ready	30 (8.79)	311 (91.21)	-
	- not ready	-	-	-
10. Favorite guarding	- left	28 (12.32)	299 (87.68)	-
	- right	2 (14.29)	12 (85.71)	-
11. Muaythai weapons domination				
	- fist	3 (6.66)	42 (93.34)	-
	- foot	24 (10.72)	200 (89.28)	-
	- knee	2 (3.33)	58 (96.67)	-
	- elbow	1 (8.33)	11 (91.67)	-

Table 4.7. shows that, only weight reduction was statistical significance difference between injured boxers and non injured boxers.

Table 4.8. Relationship and risk factors between weight reduction and head and face injuries (n=341).

Weight reduction	**Head and face injuries**		
	Injury	**Not injury**	**Total**
Reduce	18	143	161
Not reduce	12	168	180
Total	30	311	341
Relative risk	1.677		
95% CI	0.834 - 3.373		
χ^2	2.158		
p-value	.142		

Table 4.8. shows that, head and face injuries were not statistical significance related with weight reduction. If a boxer reduced weight, chances of the injuries were 1.677 folds greater than they no weight reduction.

Table 4.9. Relationship and risk factors between head guard appropriation and head and face injuries (n=341).

Head guard appropriation	**Head and face injuries**		
	Injury	**Not injury**	**Total**
Appropriate	30	311	341
Inappropriate	0	0	0
Total	30	311	341
Relative risk	Not available		
95% CI	Not available		
χ^2	Not available		
p-value	Not available		

Table 4.9. shows that, all participants claimed his head guard was appropriated. No measures of association were computed for the head guard appropriation and head and face injuries.

Table 4.10. Relationship and risk factors between head guard sliding and head and face injuries (n=341).

Head guard sliding	**Head and face injuries**		
	Injury	**Not injury**	**Total**
Slide	0	55	55
Not slide	30	256	286
Total	30	311	341
Relative risk	1.117		
95% CI	1.074 - 1.162		
χ^2	6.326		
p-value	.012		

Table 4.10. shows that, sliding head guards were not causing head and face injuries. On the other hand, when the head guards were not sliding, the chance of head and face injuries was 1.117 folds greater (with statistical significance).

Table 4.11. Relationship and risk factors between elbow guard sliding and head and face injuries (n=341).

Elbow guard sliding	**Head and face injuries**		
	Injury	**Not injury**	**Total**
Slide	0	33	33
Not slide	30	278	308
Total	30	311	341
Relative risk	1.108		
95% CI	1.068 - 1.149		
χ^2	3.524		
p-value	.060		

Table 4.11. shows that, sliding elbow guards were not causing head and face injuries. On the other hand, when the elbow guards were not sliding, the chance of head and face injuries was 1.108 folds greater (with no statistical significance).

CHAPTER V

DISCUSSION AND CONCLUSION

CONCLUSION

1. The most common cause of head and face injuries was a fist followed by a foot, a knee, and an elbow.

2. Weight reduction was external factor may related to head and face injuries.

3. Injury rate of head and face injuries was 33.1 injuries per 1,000 rounds, with Grade 1 concussion being the most frequent of the severe injuries.

DISCUSSION

This is the first video analysis for the causes of head and face injuries sustained by amateur Muaythai boxers in Thailand. Limitations in previous studies were eliminated with the use of video recordings and injury report forms. The advantage of this method is that each injury can be analyzed carefully in slow motion, regardless of how sudden the injury occurred in real time. The subjects in this study (341 boxers) were larger than previous studies - 152 and 92 boxers in Gartland et al. (15, 17) and 148 kick boxers in Buse and Wood (12) leading to clearer and more reliable results.

The most common causes of head and face injuries resulted from a fist and a foot in that order. When head and face injuries occurred, a fist was found to be most common cause of cerebral concussion (grade 1), while a foot was second. In professional boxing, only punching was allowed but head injury was still the most frequently occurring injury, especially cerebral concussion (18-19, 22). In Muaythai, Muaythai weapons with Mae-mai and Look-mai Muaythai both are permitted. Most amateur Muaythai boxers preferred kicking (65.7%) and kneeing (17.6%) (Table 4.1., pp.42). However, when the serious injuries including cerebral concussion had occurred (23 cases), a fist was more common (13 cases) than a foot (7 cases), an elbow (2 cases), and a knee (1 case) as a cause. This may be explained by the fact that, even though a kick produce higher velocity than a punch (approximately 15.9 $m \cdot sec^{-1}$ when turning-roundhouse kick in Taekwondo (25) and at 9.14 $m \cdot sec^{-1}$ when straight punching by Olympic boxers) (37) but the magnitude of the impact, the site of the impact, the magnitude of acceleration and the impact time for head and face injuries cannot be established (35). At the same time,

punching, particularly Olympic boxers, can generate a significant amount of force (3,417 N) (36) - equivalent to "a padded wooden mallet with a mass of 6 kg if swung at 20 $m \cdot h^{-1}$ (12.5 $km \cdot h^{-1}$)" (Atha et al., cited in 38). Thus, it would suggest that punching is the most dangerous form of attack in martial arts.

A knee and an elbow were also dangerous Muaythai weapons but weaker than a fist and a foot. A knee was the cause of 1 grade 1 cerebral concussion and 1 left eyebrow laceration. In addition, an elbow hurts a boxer (grade 1 cerebral concussion) in the second round. In order to use knees and elbows, boxers must be fighting at close range. This meant that the head and face were less exposed. Thus, lower incidence of head and face injuries. Nevertheless, a knee and an elbow were the causes of 4 cases of head and face injuries in first and second stage of competition (Table 4.6., pp.47). These could be a result of difference in boxer skills and strength. Injured boxers were T.K.O. in 2 cases; K.O. in 1 case; and R.S.C.I. in 1 case (Appendix F, pp.68-70). A knee and an elbow must still be considered in the prevention of head and face injuries.

Injury to the left side of the face is more common in amateur Muaythai. This could be a result of most boxers being right handed; 95.9% of boxers in this study guarded left (natural right) (Table 4.1., pp.42). Result from video analysis and amateur Muaythai record form (Appendix F, pp.68-70) revealed right punching caused open wound and abrasion/gaze to left eyelid. Right kicking caused contusion to left cheek. Right kneeing caused open wound to left eyebrow. Furthermore, right punching caused epistaxis.

Most of the injuries in this study, particularly grade 1 concussion (19 of 30 cases), needed no rest. Grade 2 concussion (4 cases) required 4-7 days rest. Abrasion/gaze and contusion rested 1-3 days and open wound required 1-4 weeks rest to completely repair. In cases of concussions, Cantu (cited in 36) recommended an athlete should return to play when asymptomatic. Even if symptoms are absent at rest, the patient should be tested during exertion. It is not unusual for symptoms to return with exertion and, in these cases, boxers should still be restricted from play.

The injuries were occurring most frequently during the third round followed by first and second round. A foot was found to be a common caused - together with a fist - of head and face injuries in first round. Head and face injuries could occur in all rounds. When beginning with 1st round to 3rd round, 28 injuries occurred from all Muaythai weapons, 6 injuries occurred in 3rd round (Table 4.5., pp.46) from a fist. Injuries occurred during the 4th round were not taken into

consideration because the difference in the number of rounds in each competition (Appendix E, pp.67). Suphanburi Games 2006 (124 boxers, 383 rounds) is an adult level of competition with 4 rounds. Nakhornpanom Games (82 boxers, 191 rounds) and Maung Kon-Dee Games (135 boxers, 333 rounds) are youth level of competition with only 3 rounds.

Head and face injuries often occurred during the first stage of competition, caused by all Muaythai weapons, especially a fist. Although, a boxer qualified to second stage of competition, a fist was still most common cause of head and face injuries followed by an elbow. Differences in Muaythai skills could be the cause of injuries together with Muaythai weapons. Seventeen cases of injuries occurred in the first stage; 9 from a fist, 5 from a foot, 2 from a knee and 1 from an elbow.

General characteristics of injured and non injured boxers were compared. There were no difference in age, weight, height, resting heart rate, blood pressure, and Muaythai experienced, but weight reduction was an exception (Table 4.7., pp.48). Mean of weight reduction in injured and non injured boxers were 2.66% and 1.59% respectively. When association of weight reduction and head and face injuries were taken into account, there was positive association but no statistical significance related (Table 4.8., pp.49). This meant that boxers who have to undergo weight reduction before a bout are at higher risk of sustaining head and face injuries. Head and face injuries might be caused from fluid loss resulting in poor performance, fatigue, tension, and reduced vigor (39-41). Even without statistical significant, weight reduction still needs to be considered as a risk of head and face injuries.

All of head guards were not showed to slide in injured boxers. But head guard sliding appeared in non injured boxers (Table 4.10., pp.51). This may be explained by - beside all head guards in this study were appropriated for boxers (Table 4.9., pp.50) - if head guard slide from pulling by the opponent in close fighting, the referee would stop the fight and reposition it. Thus, there can hardly be an incidence where head guard sliding could result in head and face injury. Ryan (18) indicated that such protection has the potential to half the estimated 453 kg (1,000 lb) force deliverable by a strong punch in amateur boxing. Nevertheless, the ability of head guard to inhibit serious brain injuries remains in doubt; this is because the most severe trauma is inflicted by rotational and angular accelerating blows which cannot be restrained by head guard (10). Therefore, head guard sliding may leads to more risk of head and face injuries, particularly laceration (10), and disturbed a boxer during a competition. From video records, if head guard

was tied by a rope at the occiput, it can reduce the sliding significantly. Muaythai head guards are different from that of amateur boxing in that they are thicker and have additional protective areas such as around the cheeks.

No elbow guard sliding occurred in injured boxers during the competition (Table 4.11., pp.52). Elbow guards sliding did occurred during competition from close fighting and deleterious of their properties. An elbow consists of medial and lateral epicondyle of humerus and olecranon of ulna (42). It is classified as a hard structure. If a boxer elbowing a head with his natural elbow - no elbow guard - it may leads to more injuries. Elbow guards' equipment modification or renewed elbow guard every three days in each competition will fully diminished risk of head and face injuries.

The rate of head and face injuries in this study (33.1 injuries per 1,000 rounds) can be classified as incidence rate (also 33.1 injuries per 1,000 athlete-exposures or AE) according to Knowles et al. (42). When compared the injury rate per 1,000 AE, injury rate in this study was more than Gartland et al.; 16.9 (17). When comparing the rate to studies in kickboxing, it was found to be less [56.6 in Zazryn et al. (16) and 67.6 in Buse and Wood (12)]. This suggests that Muaythai have fewer injuries to the head and face than that in kickboxing.

Grade 1 cerebral concussion, was - as expected - the most common severe injury. It might be possible that the result of amateur Muaythai and kickboxing are dependent on a point scoring system, with accuracy and aggressiveness also being considered. This would indicate a stronger desire for boxers to target primarily the head region, especially when attempting a knock-out. This study confirmed that most common site of injury is head and face in amateur Muaythai and kickboxing. 71.4% of injuries occurred on head and face in this study (Appendix F, pp.68-70) while previous studies found 31.0% (15); 51.6% (16); 66.7% (17); and 65.2% (12) of injuries on head and face.

Unfortunately, this study was unable to explore the consequences of a cerebral concussion especially the short and long-term effects that follows such a blow in amateur Muaythai. Participants were young and have little experience (Table 4.1., pp.42). They could have more training and competing in amateur Muaythai, as a result, repeated cerebral concussion may later affect their neurological system and brain functions (10-11, 16-22, 34).

FUTURE DIRECTION

1. Establish the rates and types of head and face injuries in larger population of amateur Muaythai boxers, as well as compare with professional Muaythai boxers.
2. Identify risk factors of head and face injuries in amateur Muaythai boxers.
3. Motion analysis for describing the biomechanics of head and face injuries.
4. Explore short and long-term effects of cerebral concussion that follows such a blow in amateur Muaythai.

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APPENDICES

APPENDIX A

AMATEUR MUAYTHAI INJURY RECORD FORM

แบบบันทึกข้อมูลการบาดเจ็บกีฬามวยไทยสมัครเล่น

ชื่อรายการ_____

รหัสนักกีฬามวยไทยสมัครเล่น_____	รหัสสังกัด_____	เพศ ☐ ชาย ☐ หญิง
อายุ_____ปี	น้ำหนัก_____กก.	รุ่น_____	ส่วนสูง_____ซม.

ส่วนที่ 1 การตรวจร่างกาย วันที่____/____/____

อุณหภูมิ (องศาเซลเซียส)	ชีพจร (ครั้งต่อนาที)	ความดันโลหิต (มม.ปรอท)	ผิวหนัง	ตา, หู, คอ, จมูก, ปาก	ทรวงอกและท้อง	ระบบประสาท	ระบบการเคลื่อนไหว	อื่นๆ

ลงชื่อ_____แพทย์ผู้ตรวจ

ส่วนที่ 2 การสอบถามและทดสอบอุปกรณ์ป้องกันศีรษะ

1) ท่านมีประสบการณ์ในการชกมวยไทยมาแล้วกี่ปี? _____ปี
2) ท่านคิดว่าท่านมีความชำนาญในการใช้อาวุธมวยไทยจากอวัยวะใดดีที่สุด? ☐ หมัด ☐ เท้า ☐ เข่า ☐ ศอก
3) ท่านต้องลดน้ำหนักตัวกี่กิโลกรัมในช่วง 1 สัปดาห์ที่ผ่านมา? _____กิโลกรัม
4) ท่านคิดว่าสภาพร่างกายของท่านพร้อมสำหรับการชกในวันนี้หรือไม่? ☐ พร้อม (เนื่องจาก_____)
☐ ไม่พร้อม (เนื่องจาก_____)
5) ท่านคิดว่าสภาพจิตใจของท่านพร้อมสำหรับการชกในวันนี้หรือไม่? ☐ พร้อม (เนื่องจาก_____)
☐ ไม่พร้อม (เนื่องจาก_____)
6) ขนาดอุปกรณ์ป้องกันศีรษะที่เหมาะสม ☐ S ☐ M ☐ L ☐ XL
7) ผลการทดสอบการหลุดเลื่อนของอุปกรณ์ป้องกันศีรษะ ☐ พอดี ☐ หลวม ☐ คับ

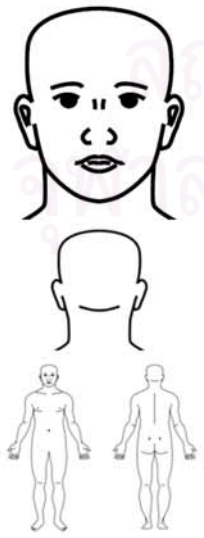
ลงชื่อ_____ผู้บันทึก

ส่วนที่ 3 บันทึกการบาดเจ็บ มุม ☐ แดง ☐ น้ำเงิน คู่ที่_____ รอบ_____

1) เวลาที่เกิด

ยก	เวลา (นาที)

แผนภาพสำหรับระบุการบาดเจ็บ



2) ตำแหน่งของร่างกายที่บาดเจ็บ
(กรุณาระบุในแผนภาพร่วมกับชนิดการบาดเจ็บ)

☐ ศีรษะ
- ☐ สมอง
- ☐ กะโหลก
- ☐ หนังศีรษะ

☐ หน้า
- ☐ หน้าผาก
- ☐ คิ้ว
- ☐ หนังตา
- ☐ ตา
- ☐ หู
- ☐ แก้ม
- ☐ จมูก
- ☐ ปาก/ฟัน/ลิ้น
- ☐ คาง
- ☐ อื่นๆ_____

☐ คอ
☐ ทรวงอก
☐ หัวไหล่
☐ แขนช่วงบน
☐ ข้อศอก
☐ แขนช่วงล่าง
☐ ข้อมือ/มือ/นิ้ว
☐ ลำตัว (หน้าอก/ท้อง/หลัง/สะโพก/ก้น)
☐ ขา (โปรดระบุ_____)
☐ อื่นๆ_____

3) ชนิดการบาดเจ็บ
(กรุณาระบุในแผนภาพโดยใช้อักษรกำกับ)

☐ a) Abrasion/Graze
☐ b) Bruise/Contusion
☐ c) Inflammation/Swelling
☐ d) Open wound/Laceration/Cut
☐ e) Sprain (Ligament/Joint)
☐ f) Strain (Muscle/Tendon)
☐ g) Dislocation/Subluxation
☐ h) Fracture
☐ i) Epistaxis
☐ j) Concussion/Brain injury/Amnesia
☐ k) Dental injury
☐ l) อื่นๆ_____

4) ความรุนแรงของการบาดเจ็บ

การบาดเจ็บต่อระบบกระดูกและกล้ามเนื้อ
(กรุณาประมาณระยะเวลาการหลุดพ้นจากการฝึกซ้อมและแข่งขัน)
☐ ไม่พัก ☐ 4-7 วัน ☐ > 1 เดือน
☐ 1-3 วัน ☐ 1-4 สัปดาห์
Open wound/Laceration/Cut
ขนาด (ประมาณ)_____ซม.
ความลึก (ประมาณ)_____
Concussion/Brain injury
(พิจารณาตาม Severity of Concussion)
☐ Grade 1 ☐ Grade 2 ☐ Grade 3

5) การให้การรักษาข้างสนาม
กรุณาอธิบาย_____

6) การส่งรักษาต่อ
☐ ไม่ส่งต่อ
☐ ส่งไปโรงพยาบาล_____
☐ อื่นๆ_____

7) ผลการแข่งขัน
☐ ชนะ ☐ แพ้
โดย_____

Severity of Concussion

Grade	Symptoms	
	Loss of Consciousness	Posttraumatic Amenia
1 (Mild)	No	1-30 min
2 (Moderate)	Less than 5 min	> 30 min – 24 hr
3 (Severe)	5 min or more	24 hr or more

ลงชื่อ_____ผู้บันทึก/แพทย์สนาม

APPENDIX B

LIST OF THE EXPERTS WHO APPROVED

AMATEUR MUAYTHAI INJURY RECORD FORM

Name	Position	Institution
1. Mr. SOMCHAI SRIPIEW	Chairman of Technical Committee	International Federation of Muaythai Amateur: IFMA
	Member	Amateur Muaythai Association of Thailand: AMTAT
2. Mr. SUWIT KERDBUMRUNG	Chief of Medical Service Section	Sports Medicine Services Division, Sports Science Department, Sports Authority of Thailand
3. Mrs. SOPA VITITAMONVET	Nurse 6	Sports Medicine Services Division, Sports Science Department, Sports Authority of Thailand

APPENDIX C

INFORMATION SHEET AND INSTRUCTION FOR AMATEUR MUAYTHAI BOXERS TO CONSENT IN VIDEO RECORDING DURING MUAYTHAI COMPETITION

ชื่อโครงการ การวิเคราะห์สาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่นด้วยกล้องวิดีโอ

(Project) (Video Analysis for the Causes of Head and Face Injuries in Amateur Muaythai Boxers)

เรียน นักกีฬามวยไทยสมัครเล่นทุกท่าน

ท่านได้รับเชิญให้เข้าร่วมการศึกษาหาสาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าจากการแข่งขันกีฬามวยไทยสมัครเล่น เพื่อเป็นแนวทางในการป้องกันการบาดเจ็บที่จะเกิดขึ้น โดยการศึกษานี้จะทำการบันทึกภาพขณะที่ท่านทำการแข่งขันกีฬามวยไทยสมัครเล่นทุกยกทุกนัดจากรายการ_____
ด้วยกล้องวิดีโอ จำนวน 2 ตัว โดยติดตั้งขนานเวที 1 ตัว และเป็นกล้องวิดีโอเคลื่อนที่อีก 1 ตัว จากนั้นจะนำภาพจากการบันทึกวิดีโอเทปของท่านมาใช้ในการวิเคราะห์หาสาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าต่อไป

หากท่านตกลงที่จะเข้าร่วมการศึกษาและยินยอมให้บันทึกภาพของท่าน ผู้วิจัยจะมีข้อปฏิบัติร่วมกับท่านดังต่อไปนี้

1. ท่านไม่ต้องเสียค่าใช้จ่ายใดๆ ในการเข้าร่วมการศึกษา
2. การบันทึกวิดีโอเทปขณะแข่งขัน จะไม่รบกวนหรือกีดขวางการแข่งขันของท่าน และจะไม่ส่งผลต่อการแข่งขันใดๆ ทั้งสิ้น
3. ขอให้ท่านแสดงความสามารถในการแข่งขันให้เต็มที่ เพื่อผลการแข่งขันที่ดีที่สุดของท่าน

ขอขอบคุณในความร่วมมือของท่านมา ณ ที่นี้

ลงนาม_____ผู้วิจัย

(นายดิฏฐชัย จันทร์คุณา)

หมายเลขติดต่อ 08-9983-3516

APPENDIX D

CONSENT FORM

ชื่อโครงการ การวิเคราะห์สาเหตุการบาดเจ็บบริเวณศีรษะและใบหน้าในนักกีฬามวยไทยสมัครเล่นด้วยกล้องวิดีโอ

(Project) (Video Analysis for the Causes of Head and Face Injuries in Amateur Muaythai Boxers)

วันที่ให้การยินยอม วันที่____เดือน_____พ.ศ._____

ก่อนที่จะลงนามในใบยินยอมให้บันทึกภาพขณะที่ข้าพเจ้าทำการแข่งขันกีฬามวยไทยสมัครเล่นทุกยกทุกนัดในรายการ_____ระหว่างวันที่_____ถึง_____เดือน_____ พ.ศ._____ นี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยถึงวัตถุประสงค์ วิธีการ และข้อปฏิบัติร่วมกัน ซึ่งทำให้ข้าพเจ้ามีความเข้าใจดีแล้ว

ข้าพเจ้ามีสิทธิที่จะบอกเลิกไม่ให้บันทึกภาพ อีกทั้งขอให้ลบภาพที่ได้ทำการบันทึกในการแข่งขันนี้เมื่อใดก็ได้ และยินยอมให้บันทึกวิดีโอเทปโดยสมัครใจ อีกทั้งการบอกเลิกจะไม่มีผลต่อการแข่งขันของข้าพเจ้า

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าและเทปบันทึกภาพตัวข้าพเจ้าไว้เป็นความลับ และจะเปิดเผยได้เฉพาะในรูปที่เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่างๆ ที่เกี่ยวข้อง กระทำได้เฉพาะกรณีจำเป็น ด้วยเหตุผลทางวิชาการเท่านั้น

ผู้วิจัยรับรองว่าหากข้าพเจ้าได้รับบาดเจ็บขณะทำการแข่งขัน จะได้รับการรักษาพยาบาลโดยไม่คิดมูลค่าจากแพทย์สนามประจำการแข่งขันนี้

ข้าพเจ้าได้อ่านข้อความข้างต้นนี้แล้ว มีความเข้าใจดีทุกประการ และได้ลงนามยินยอมในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม_____ผู้ยินยอม

(_____)

ลงนาม_____ผู้แทนโดยชอบธรรม

(_____)

ความสัมพันธ์ของผู้แทนโดยชอบธรรมกับผู้เข้าร่วมวิจัย_____

ลงนาม_____พยาน

(_____)

ลงนาม_____ผู้วิจัย

(นายดิฏฐชัย จันทร์คุณา)

หมายเลขติดต่อ 08-9983-3516

APPENDIX E

AMATEUR MUAYTHAI COMPETITIONS DATA

Competition / Date	Host Province	Weight Division	Male Boxers	Bouts		Rounds	
				Expected	Real	Expected	Real
The 35th National Games: "Suphanburi Games 2006" / September 9th - 19th, 2006[1]	Suphanburi	9	124	115	106	460	383
The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" / October 9th - 19th, 2006[2]	Nakornpanom	10	82	72	65	216	191
The 23rd National Youth Games: "Maung Kon-Dee Games" / March 20th - 30th, 2007[2]	Suratthani	10	135	125	119	375	333
Total			341	312	290	1,051	907

Remark: [1] is adult level of competition; consist of 3 minutes of 4 rounds with 2 minutes rest between.

[2] is youth level of competition; consist of 2 minutes of 3 rounds with 1 minute rest between.

APPENDIX F

RESULT FROM VIDEO ANALYSIS OF THE INJURIES IN AMATEUR MUAYTHAI BOXERS

No.	Date	Bout (Master program)	Weight Division	Injured Corner	Injuries Site	Injuries Type	Severity of Injuries (Reviewed by experienced ringside physician)	Round (Time)	Competition Stage	Cause from Muaythai Weapons	Result of Injured Corner (Round)	Remark
1	Sep. 10, 06	5	57 kg	Blue	Abdomen	Bruise/Contusion	Rest 1-3 days	Round 3 (1.00)	First	Knee	Lose by K.O. (3)	
2		10	63.5 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.02)	First	Knee	Lose by T.K.O. (1)	RA
3	Sep. 11, 06	2 (20)	51 kg	Red	Abdomen	Colic	Not rest	Round 3 (1.50)	First	Knee	Lose by R.S.C.O. (4)	
4		4 (51)	51 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 4 (0.32)	First	Fist	Win by point	RA
5		10 (28)	54 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.45)	First	Foot	Lose by point	RA
6		14 (54)	54 kg	Blue	Abdomen	Colic	Not rest	Round 4 (2.15)	First	Knee	Lose by T.K.O. (4)	
7		16 (34)	60 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 4 (1.32)	First	Fist	Lose by T.K.O. (4)	RA
8		18 (36)	60 kg	Red	Face, Left eyebrow	Open wound	1.5 x 0.2 cm (Rest 1-4 weeks)	Round 1 (0.35)	First	Knee	Lose by R.S.C.I. (1)	Refer
9	Sep. 12, 06	2 (42)	45 kg	Red	Face, Left eyelid	Abrasion/Graze	Rest 1-3 day	Round 3 (1.30)	First, Bronze	Fist	Lose by point	
10		14 (54)	63.5 kg	Red	Left ankle	Sprain	Rest 4-7 days	Round 3 (1.30)	First	Not available	Lose by R.S.C.I. (3)	
11		17 (57)	71 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.16)	First	Foot	Lose by K.O. (1)	RA
12		18 (58)	71 kg	Blue	Face, Left cheek	Contusion	Rest 1-3 days	Round 1 (0.59)	First	Foot	Lose by K.O. (1)	
13		18 (58)	71 kg	Blue	Head, Brain	Concussion	Grade 2 (Rest 4-7 days)	Round 1 (1.56)	First	Fist	Lose by K.O. (1)	RA1
14		20 (60)	71 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.02)	First	Foot	Lose by R.S.C.O. (2)	RA

Remark: AC jt. = Acromioclavicular joint, Gr II = Grade II, K.O. = Knock out, T.K.O. = Technical knock-out, R.S.C. = Referee stop contest, R.S.C.I. = Referee stop contest because injury, R.S.C.H. = Referee stop contest because injury to the head, R.S.C.B. = Referee stop contest because injury to the body, R.S.C.O. = Referee stop contest because outclass or weak skills, RA = Return to play when asymptomatic, RA1 = Return to play when asymptomatic for 1 week.

No. 1-23 were injuries occurring in The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.

No. 24-25 were injuries occurring in The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.

No. 26-42 were injuries occurring in The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.

APPENDIX F

RESULT FROM VIDEO ANALYSIS OF THE INJURIES IN AMATEUR MUAYTHAI BOXERS

No.	Date	Bout (Master program)	Weight Division	Injured Corner	Injuries Site	Injuries Type	Severity of Injuries (Reviewed by experienced ringside physician)	Round (Time)	Competition Stage	Cause from Muaythai Weapons	Result of Injured Corner (Round)	Remark
15	Sep. 13, 06	12 (72)	60 kg	Red	Face, Left eyelid	Open wound	1.0 x 0.2 cm (Rest 1-4 weeks)	Round 2 (1.30)	Bronze	Fist	Lose by point	Refer
16	Sep. 14, 06	9 (85)	71 kg	Blue	Abdomen	Colic	Not rest	Round 2 (1.00)	Bronze	Knee	Lose by R.S.C.B. (2)	
17		12 (88)	71 kg	Red	Abdomen	Colic	Not rest	Round 2 (1.00)	Bronze	Knee	Lose by R.S.C.B. (2)	
18	Sep. 15, 06	3 (91)	54 kg	Red	Head, Brain	Concussion	Grade 2 (Rest 4-7 days)	Round 1 (0.59)	Semi-final	Foot	Lose by K.O. (1)	RA1
19		6 (88)	60 kg	Red	Right ankle	Sprain	Rest 1-4 weeks	Round 2 (1.00)	Semi-final	Not available	Lose by R.S.C.O. (2)	
20	Sep. 16, 06	2 (98)	45 kg	Red	Trunk (Left side)	Fracture (Rib)	Rest 1-4 weeks	Round 1 (2.00)	Semi-final	Foot	Lose by retirement (2)	Refer
21		7 (103)	63.5 kg	Red	Head, Brain	Concussion	Grade 2 (Rest 4-7 days)	Round 2 (0.58)	Semi-final	Fist	Lose by K.O. (2)	RA1
22	Sep. 18, 06	4 (110)	54 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (0.31)	Final	Foot	Lose by K.O. (1)	RA
23		6 (112)	60 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 3 (1.30)	Final	Fist	Lose by K.O. (3)	RA
24	Oct. 11, 06	7	60 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.00)	First	Elbow	Lose by K.O. (2)	RA
25		11	67 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 3 (1.45)	First	Fist	Win by point	RA
26	Mar. 21, 07	7	51 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 3 (1.45)	First	Fist	Lose by K.O. (3)	RA
27		20	60 kg	Blue	Face, Nose	Epistaxis	Not rest	Round 3 (1.35)	First	Fist	Lose by point	
28		22	67 kg	Blue	Head, Brain	Concussion	Grade 2 (Rest 4-7 days)	Round 1 (0.15)	First	Fist	Lose by K.O. (1)	RA1

Remark: AC jt. = Acromioclavicular joint, Gr II = Grade II, K.O. = Knock out, T.K.O. = Technical knock-out, R.S.C. = Referee stop contest, R.S.C.I. = Referee stop contest because injury, R.S.C.H. = Referee stop contest because injury to the head, R.S.C.B. = Referee stop contest because injury to the body, R.S.C.O. = Referee stop contest because outclass or weak skills, RA = Return to play when asymptomatic, RA1 = Return to play when asymptomatic for 1 week.

No. 1-23 were injuries occurring in The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.

No. 24-25 were injuries occurring in The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.

No. 26-42 were injuries occurring in The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.

APPENDIX F

RESULT FROM VIDEO ANALYSIS OF THE INJURIES IN AMATEUR MUAYTHAI BOXERS

No.	Date	Bout (Master program)	Weight Division	Injured Corner	Injuries Site	Injuries Type	Severity of Injuries (Reviewed by experienced ringside physician)	Round (Time)	Competition Stage	Cause from Muaythai Weapons	Result of Injured Corner (Round)	Remark
29	Mar. 22, 07	1 (24)	48 kg	Red	Left shoulder (AC jt.)	Strain	Rest 1-3 days	Round 2 (1.40)	First	Not available	Lose by R.S.C.I. (2)	
30		5 (28)	48 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.28)	First	Foot	Lose by T.K.O. (1)	RA
31		7 (30)	48 kg	Red	Face, Nose	Epistaxis (Anterior)	Not rest	Round 2 (1.10)	First	Fist	Lose by point	
32		20 (43)	63.5 kg	Red	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.00)	First	Fist	Lose by R.S.C.H. (1)	RA
33	Mar. 23, 07	6 (51)	45 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.20)	Second	Fist	Lose by R.S.C.H. (1)	RA
34		13 (58)	54 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.00)	Second	Foot	Lose by T.K.O. (2)	RA
35		15 (60)	67 kg	Red	Face, Nose	Epistaxis	Not rest	Round 3 (1.35)	Second	Fist	Lose by point	
36		17 (62)	67 kg	Blue	Left shoulder (AC jt.)	Subluxation	Rest 4-7 days	Round 1 (0.47)	Second	Foot	Lose by R.S.C.I. (1)	
37	Mar. 24, 07	10 (73)	63.5 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.30)	Second	Elbow	Lose by T.K.O. (2)	RA
38		11 (74)	63.5 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (0.50)	Second	Fist	Lose by R.S.C.H. (2)	RA
39		13 (76)	71 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 1 (1.10)	Second	Fist	Lose by T.K.O. (1)	RA
40	Mar. 25, 07	14 (93)	60 kg	Blue	Head, Brain	Concussion	Grade 1 (Not rest)	Round 2 (1.44)	Second	Fist	Lose by R.S.C.H. (2)	RA
41	Mar. 26, 07	1 (96)	45 kg	Red	Trunk, Chest	Bruise/Contusion	Not rest	Round 2 (1.25)	Semi-final	Knee	Lose by K.O. (2)	
42	Mar. 27, 07	3 (108)	48 kg	Red	Left leg	Bruise/Contusion (Gr II)	Rest 1-3 days	Round 3 (1.50)	Semi-final	Foot	Win by point	

Remark: AC jt. = Acromioclavicular joint, Gr II = Grade II, K.O. = Knock out, T.K.O. = Technical knock-out, R.S.C. = Referee stop contest, R.S.C.I. = Referee stop contest because injury, R.S.C.H. = Referee stop contest because injury to the head, R.S.C.B. = Referee stop contest because injury to the body, R.S.C.O. = Referee stop contest because outclass or weak skills, RA = Return to play when asymptomatic, RA1 = Return to play when asymptomatic for 1 week.

No. 1-23 were injuries occurring in The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.

No. 24-25 were injuries occurring in The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.

No. 26-42 were injuries occurring in The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.

APPENDIX G

LIST OF STAFFS IN RINGSIDE PHYSICIAN UNIT

1. The 35th National Games: "Suphanburi Games 2006" during September 9th - 19th, 2006 in Suphanburi, Thailand.

Name (Position)	Institution
1) Mr. SUWIT KERDBUMRUNG (Chief of Medical Service Section)	Sports Medicine Services Division, Sports Science Department, Sports Authority of Thailand
2) Dr. MEECHAI INWOOD, M.D. (Doctor 6)	
3) Dr. SETHAPONG SRISUPORNWANICH, M.D. (Doctor 4)	Chaoprayayomraj Hospital, Suphanburi
4) Dr. PRAMCHAI THANYAPHALINA, M.D. (Doctor 4)	
5) Dr. SOMPORN BAWONSRISUK, M.D. (Doctor 4)	
6) Dr. PICHED SRIWATTANASAKUL, M.D. (Doctor 4)	
7) Dr. CHATCHAI SAMAKKEENICH, M.D. (Doctor 6)	
8) Dr. PEERAPATANA CHEEWA-ISSARAKUL, M.D. (Doctor 5)	
9) Dr. KAMNUAN PHUNSRI, M.D. (Doctor 8)	
10) Dr. KRISSANA SUWANNAKOMOLCHAI, M.D. (Doctor 6)	
11) Dr. WEERACHAI KIJRUNGPAIBOON, M.D. (Doctor 7)	
12) Dr. PAIROJ PINJEESAEKIKUL, M.D. (Doctor 7)	
13) Dr. WARODOM LIMSRIJAROEN, M.D. (Doctor 6)	
14) Dr. DHEEWAPORN EIMPHUN, M.D. (Doctor 8)	
15) Dr. NITHI PRAJONGKARN, M.D. (Doctor 8)	
16) Dr. SOMPORN BHAWORNSRISUK, M.D. (Doctor 4)	

APPENDIX G

LIST OF STAFFS IN RINGSIDE PHYSICIAN UNIT

2. The Region 3 Qualifying for the 23rd National Youth Games: "Nakornpanom Games" during October 9th - 19th, 2006 in Nakornpanom, Thailand.

Name (Position)	Institution
1) Mr. NOPPAWONG MONGKOLSAWADEE (Technical Nurse 6)	Nakornpanom Hospital, Nakornpanom
2) Miss KHANITTHA SRIRINOPPAKUL (Technical Nurse 6)	
3) Mrs. SRIRIWAN TONGNOI (Patient Assistant)	
4) Mrs. CHUTIMA NUNNIYONG (Nurse 7)	
5) Mrs. THANANYA SINGHACHAKORN (Nurse 7)	

3. The 23rd National Youth Games: "Maung Kon-Dee Games" during March 20th - 30th, 2007 in Suratthani, Thailand.

Name (Position)	Institution
1) Dr. EAD LORPRAYUN, M.D. (Doctor 7)	Sports Medicine Services Division, Sports Science Department, Sports Authority of Thailand
2) Dr. MEECHAI INWOOD, M.D. (Doctor 6)	
3) Miss SUNISA POLYIAM (Nurse 4)	
4) Dr. EKKACHAI TERMVIRIYAKUL, M.D. (Doctor 6)	Kohsamui Hospital, Suratthani
5) Dr. NISA LIMSUWAN, M.D. (Doctor 5)	
6) Dr. SUWICHAI PATHOMPANITRAT, M.D. (Doctor 8)	
7) Dr. PHALANGTHEP PRAPAIJUKKIT, M.D. (General practitioner)	Bangkok Samui Hospital, Suratthani

BIOGRAPHY

Mr. Dittcahai Chankuna was born on 24th November 1981 in Chiang mai, Thailand. He graduated Bachelor of Science in Sports Science, Faculty of Physical Education at Srinakharinwirot University (Ongkharak campus), Thailand in academic year 2003. After that, he has been studying Master of Science in Sports Medicine, Faculty of Medicine at Chulalongkorn University, Thailand since academic year 2004.

Academic achievements:

- Dissertation of Bachelor of Science (Sports Science) in 2003: "Effect of difference body preparations to peak anaerobic power output"
- Public article in Journal of Sports Science, issue of January 2007, Sports Authority of Thailand: "Sports Medicine preparation in athletes for The 15th Asian Games Competition"
- Public article in Journal of Sports Science, issue of January 2007, Sports Authority of Thailand: "Sports Medicine and Billiards"