Hand and Wrist Injuries in Mixed Martial Arts: A Guide to Diagnosis and Treatment

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7.1 Introduction

The sport that we call mixed martial arts (MMA) is different from other more "traditional" martial arts in that it employs striking and grappling techniques from multiple disciplines. It is related to other "no-holds-barred" fighting disciplines such as pankration, which dates to Greek antiquity [1]. While MMA is not unique in combining many forms of combat, it is unique in its recent development and evolution to sport. It was not until 1993 when what we consider modern day MMA began to take form. In that year the Ultimate Fighting Championship (UFC) was started with the intention of placing competitors of different martial arts against each other to see which art was the most effective in combat. It was a "no-holds-barred" event meaning that minimal rules governed what techniques could be used against one another. It was overtly violent and, comprised of many size and skill mismatches. Many found it distasteful. The public backlash resulted in the sport being banned in many states within the United States of America (USA). However, in the late 1990s and early 2000s, an effort was made to increase the safety of the sport and make it more spectator-friendly. Since that time, the sport has evolved greatly and experienced a surge in popularity making it one of the fastest growing sports in the world [2]. It was reported in 2012 [3] that 5.5 million teenagers and another 3.2 million children participate in MMA in the USA, which is comparable to other more traditional sports such as baseball and American football. The UFC recently sold for over $4 billion reflecting its worldwide presence and popularity [4]. As the sport has evolved, what used to be a contest of one martial art versus another has become a combination of those arts and a new sport in itself.

Given the popularity of the sport, it is important for physicians and surgeons to be able to understand and anticipate the injuries that athletes may sustain during their participation. Given the overlap of MMA with boxing, wrestling, Brazilian Jiu Jitsu, judo, Muay Thai kickboxing, and other martial arts (see Table 7.1), there is also an overlap in the occurrence of injuries. However, MMA is its own sport that does require its own analysis. This article will emphasize the rules, techniques, and equipment that may contribute to injuries of the hand and wrist as well as a review of the current available literature. As a former competitor in MMA and a fellowship-trained hand surgeon, I have a unique perspective and access to the sport.

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Table 7.1 General comparison between various martial arts

Martial art	Strikes with the hand (fists)	Strikes with elbows or forearm	Strikes with knees	Strikes with kicks (including shin or foot)	Biting	Strikes with the head	Throws or takedowns	Fighting on the ground	Submissions	Chokes	(Generalized) targeted areas	Fight area	Gloves/ weight of gloves	Apparel (based on highest competition level)	% with hand/wrist injury (if available)
Judo[a]	No	No	No	No	No	No	Yes[b]	Yes	Yes	Yes	Extremities or neck	Mats with defined out of bounds without barrier	No	Gi with belt	6–30 [5–7]
Wrestling[c]	No	No	No	No	No	No	Yes[b]	Yes	No	No	Extremities or neck	Mats with defined out of bounds without barrier	No	Singlet and specific foot wear	3.5–11.0 [6, 8–10]
Brazilian Jiu Jitsu[d]	No	No	No	No	No	No	Yes	Yes[b]	Yes	Yes	Extremities or neck	Mats with defined out of bounds without barrier	No	Gi with belt or low profile clothing for no Gi contests	11.1 [11]
Sambo[e,f]	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Extremities or neck	Mats with defined out of bounds without barrier	Dependent on venue/ 4–6 oz	Gi top, shorts, headgear, mouth guard, groin protection, open fingered gloves, leg pads covering the front part of the shin and lacing of specific foot wear	NA
Karate[g]	Yes	No	No	Yes	No	No	Yes	No	No	No	Head and trunk	Mats with defined out of bounds without barrier	Dependent on venue/4–10 oz	Kimono with belt, body protection, karate mitts, foot pads, shin pads, mouth guard, with or without groin protection	3.0–12.5 [12–14]

Boxing[h]	Yes[b]	No	No	No	No	No	No	No	No	No	Head and trunk	Enclosed area within ropes	Yes/8–10 oz. for competition up to 16 oz. for training	Shorts, specific foot wear, groin protection, mouth guard, hand wraps with or without headgear	6.5–17 [6, 15–17]
Muay Thai[i]	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No	Few restrictions	Enclosed area within ropes	Yes/8–10 oz. for competition up to 16 oz. for training	Boxing gloves, hand wraps, shorts, groin protection	2.3–2.9 [18, 19]
Taekwondo[j]	Yes	No	No	Yes[b]	No	No	No	No	No	No	Head and trunk	Octagonal mats with defined out of bounds without barrier but on platform	Dependent on venue (becoming more common) /4 oz	Dobok with trunk protector, headgear, mouthpiece, groin area protector, gloves, and shin and forearm guards	8–10.8 [7, 20, 21]
MMA[k]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Few restrictions	Enclosed area within ropes or cage	Yes/4–6 oz	Gloves, hand wraps, mouthpiece, shorts, groin protection	5–17.7 [22–28]

[a] http://www.nbcolympics.com/news/judo-101-rules-scoring#scoring
[b] Primary attack (perhaps numerical classification in a seperate location)
[c] http://www.nbcolympics.com/news/wrestling-101-rules
[d] https://www.usgrappling.com/rules/
[e] Some variations of rules allow striking (perhaps numerical classification in a seperate location)
[f] http://sambofias.org/uploads/documents/FIAS/FIAS_Sambo_Rules_2015_EN.pdf
[g] http://www.wkf.net/pdf/wkf-competition-rules-version9-2015-en.pdf
[h] http://www.teamusa.org/usa-boxing/rulebook/competition-rules
[i] http://www.ikfkickboxing.com/RulesMT.htm
[j] http://www.worldtaekwondofederation.net/rules/
[k] http://www.ufc.com/discover/sport/rules-and-regulations

7.2 Mixed Martial Arts

To understand MMA, one should have a brief understanding of the terminology involved. Martial arts are the practice of combat and self-defense and have likely existed for as long as civilization [1, 29]. There are many different types of martial arts with different cultural influences and emphases, but all have the objective of engaging an opponent in direct combat. Often, they become sporting contests with rules that dictate the objectives of the contest and increase safety. For MMA, what used to be a contest to see which martial art is superior has morphed into a combination of the martial arts, hence the name mixed martial arts.

There are countless techniques that one can use against another person to gain superiority in combat, but they can be organized into general categories. "Striking" is when a person uses their extremities to strike their opponent and requires some distance, also known as range, between the combatants. Strikes in MMA most often involve the hands in the form of a closed fist but, for example, can also be with an open hand (fingers extended), elbows, knees, shins, or the feet. "Grappling" involves closer range combat that requires grasping of the opponent. Grappling often involves bringing the engagement to the ground via a throw or "takedown." Other attacks include joint manipulation such as hyperextension or twisting and have been termed "submissions." To successfully use a "submission," torque on the joint is created by applying force through moment arms proximally and distally to the joint. An example of this would be by performing an "arm bar," which creates hyperextension at the elbow by directing force on the humerus in one direction and then applying an opposite force through the forearm (Fig. 7.1). Chokes are attacks where the ability to breath and/or blood supply to the brain is temporarily cut off. The opponent can concede, or "submit", to their opponent before injury, or unconsciousness occurs via signal. Often the signal will be tapping their hand repeatedly onto their opponent or "tapping out," but the signal can also be verbal.

7.3 Rules in MMA

Unified Rules and Regulations of Mixed Martial Arts exist [30] and contributed to the growing acceptance of the sport. I intend to summarize the rules in a way that applies to the goals of this paper. For a full list of rules and regulations, see reference. A general comparison of martial arts can be seen in Table 7.1 including legal techniques, fighting area, and apparel.

The Fighting Area: The contest usually takes place on a flat surface with foam padding and lined with canvas or similar material to prevent

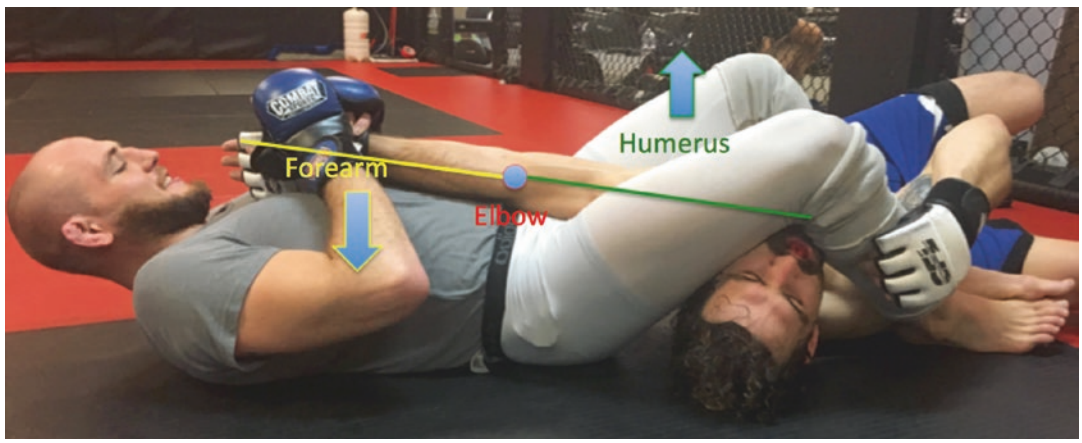

Fig. 7.1 Arm bar

Fig. 7.2 Mixed martial arts gloves/boxing gloves. Standard MMA glove with open fingers compared to 16 oz. training/sparring boxing glove

slipping if wet. It may be bordered by a chain link fence or "cage" of various shapes or may be similar to a boxing ring lined with ropes. The most famous example is in the UFC, which trademarked an eight-sided cage or "the Octagon." It is illegal to intentionally grasp the cage or fence although leaning into or pushing off of it or pushing one's opponent against it are common tactics.

Potential Injuries: The fighting area itself is a rare source of reported injuries as grasping the cage or fence is illegal; however, it is a possibility that a digit may become caught within the cage or the junction with the floor, resulting in a twisting or avulsion type of injury. In a small survey [22], 12% of respondents did report an injury as a result of the cage.

Fighting Apparel: Include groin protection, shorts or similar lower extremity clothing, mouth guard, hand wraps, and gloves. The gloves are usually 4 oz. (113 g) but can be 6 oz. (170 g) for larger-sized fighters. The gloves have open, independent fingers with padding extending over the metacarpophalangeal (MCP) joints and the proximal phalanges but end at the proximal interphalangeal (PIP) joints (Fig. 7.2). In comparison, modern competition boxing gloves weigh 8–10 oz. (227–284 g) and completely enclose the fingers and thumb, which cannot be separated from the fist (Fig. 7.2). Lastly, but importantly, it is illegal to grasp the apparel.

Potential injuries: Gloves for combat sports are utilized primarily to protect ones hands [29, 31, 32] and not necessarily the opponent being struck. Closed-fisted punching is more utilized in striking arts when gloves are allowed as they reduce the risk of injury to the person throwing the punch [29]. In MMA, since the fingers of the gloves are independent, they are subject to forces not seen in boxing such as twisting, hyperextension, and similar type of injuries. With the gloves ending at the proximal phalanx, the PIP joint likely sees increased forces. An example of an injury is seen in the publicly available photo of UFC fighter Josh Emmett with an open ring finger dorsal PIP joint dislocation (Fig. 7.3). Also, the thumb, in its lateral position on the hand, can be snagged or impacted while throwing punches that is not possible with modern boxing gloves (see representation in Fig. 7.4). Older boxing gloves had an independent thumb, and Noble [31] noted in a study in 1987 that 39% of boxer's injuries were to the thumb and the majority

Fig. 7.3 Josh Emmett open ring finger PIP dislocation injury

Fig. 7.4 Example of independent thumb being deviated away from the hand during a punch

(23/39 injuries) of these were ruptures of the MCP joint ulnar collateral ligament (UCL). Additionally, the smaller gloves in MMA compared to boxing impart similar force to a smaller area resulting in higher peak forces [33, 34] with potentially increased injury to the hand compared to larger gloves.

Since grasping clothing is not legal, the risk of some injuries is reduced. When fingers can be caught in clothing, shear and twisting injuries to the fingers such as flexor digitorum profundus (FDP) avulsion injuries also known as "jersey fingers," pulley injuries, and other sprains can occur. Sports where gripping clothing is very common, such as judo [5] and Brazilian jiujitsu [11] are noted to have these types of injuries. In the survey [22] of MMA fighters, only 2% of injuries were directly blamed on the apparel worn such as getting the fingers snagged within the shorts of their opponent.

Rules of Engagement: Specific rules in place for overall fighter safety also contribute possible hand injuries in MMA. Some injuries are less likely due to the illegality of grasping the cage or the opponent's clothing as previously discussed but also because finger joint manipulation is illegal. Other rules that contribute to a unique injury profile for MMA include the legality of kicks, but illegality of striking the back of the head or neck as well as kicking or kneeing the head of a downed opponent. These will be discussed in further detail in the coming paragraphs.

A rule that fortunately prevents many injuries to the hand and fingers is that intentional finger joint manipulation is not allowed. This means that a person may not grab an individual finger and bend or twist it. Manipulation of the wrist joint is legal but is less commonly targeted compared to other larger joints. It is difficult to isolate the wrist joint and keeping it trapped compared to larger joints, which have longer moment arms that are easier to grasp and manipulate.

Potential Injuries: As mentioned before, striking with a closed fist is the most commonly employed strike in MMA, and an injury profile similar to other striking sports like boxing is expected. However, there are several ways in which MMA may allow for different hand injuries compared to other striking arts beyond the previously discussed gloves. First, there are often situations when powerful kicks impact the lightly padded defender's hand or wrist potentially causing injury, as may be seen in taekwondo or karate. Also, given the grappling component of MMA, there are many situations where the back of the opponent's head and neck are exposed to strikes; however it is illegal to hit these areas. To avoid executing an illegal strike, one needs to angle or "loop" the punch toward the legal target areas, creating impact on the radial or ulnar hand as opposed to directly over the MCP joints (Fig. 7.5). Specifically, the thumb and second ray as well as the ulnar hand are exposed to forces not usually seen in boxing or

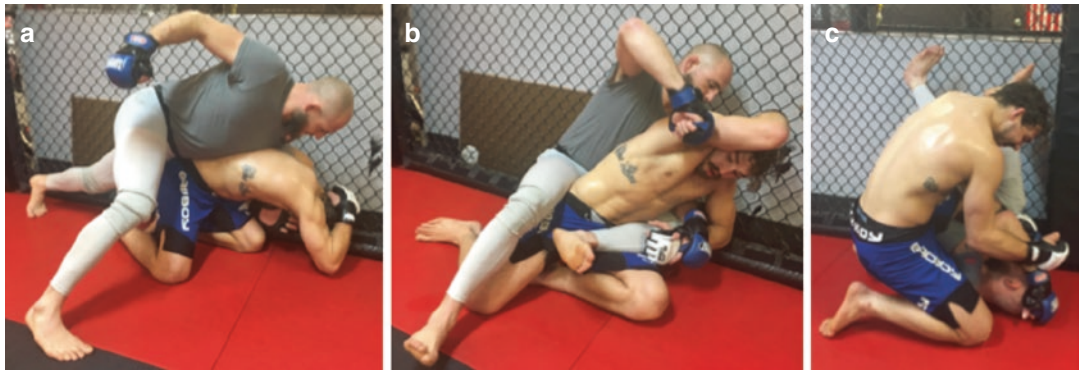

Fig. 7.5 Examples of looping punches to avoid illegal strike (**a**) uppercut from behind (**b**) indirect punch from behind (**c**) hammer punch from top position

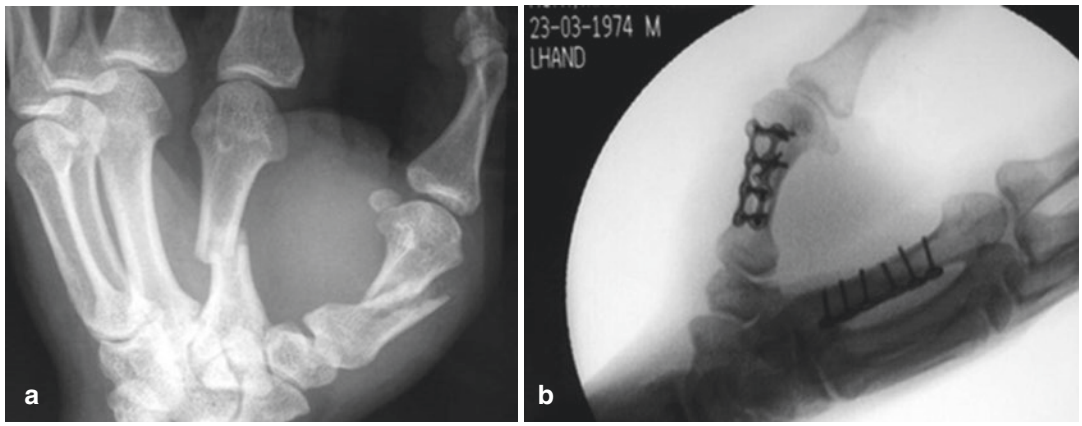

Fig. 7.6 Mark Hunt's fractured hand (source: Mark Hunt's Facebook Page)

kickboxing but are seen in karate or taekwondo. The decreased padding, independent fingers, and unique forces on the hand will result in a unique injury profile. A representative case is UFC fighter Mark Hunt (a former champion kickboxer and now competitor in MMA) who injured his hand and placed photos available publicly on his social media website (Figs. 7.6a and 7.6b).

The ground-fighting component of the sport also contributes to injury. For safety reasons, it is not legal to kick or knee the head of an opponent that has anything but their feet touching the ground. Due to this ground-fighting constraint of MMA, there are situations where the aggressor must use his arms to strike the opponent instead of the legs increasing the chances of injury to the hand. Also, when trying to punch a moving opponent on the ground, it is possible to actually strike the ground instead, which may result in injury.

7.4 Review of Literature

An English language literature search of PubMed, Cochrane, and Google Scholar of "Mixed Martial Arts Injuries" revealed 51 publications. Case reports and articles relating to topics other than injuries to the extremities were excluded. Review of abstracts allowed the search to be narrowed to 11 publications. Review of those articles left eight articles that addressed the goal of assessing the rate of upper extremity

Table 7.2 Review of available articles discussing upper extremity injuries in Mixed Martial Arts

Paper	Year	Type of study	Source of information	Number of matches/ fighters	Average age/ gender	Number of injuries/ fighters injured	Number of upper extremity injuries (percent of total injuries)	Types of injuries (not specific to upper extremity injuries unless specified)	Overall injury rate
Bledsoe et al. [28]	2006	Retrospective cohort study	Nevada State Athletic Commission 2001–2004	171/220	28.5 years/100% male	96/78	21 (21.9%)	Specifics not detailed. Most common injury was facial laceration (47.9% of injuries or a rate of 13.45/100 competitors)	28.6 per 100 fight participations (0.286/exposure)
							Hand: 13 (13.5%)		Hand injuries 13.5% or a rate of 3.8/100 competitors
							Shoulder: 5 (5.2%)		
							Elbow: 3 (3.1%)		
							Arm: 1 (1%)		
Ngai et al. [35]	2008	Retrospective cohort study	Nevada State Athletic Commission 2002–2007	635/1270	NA/100% male	356/300	67 (18.8%)	"Upper limb injuries": occurred in 6.5% decisions, 7.7% of TKO, 3.3% of submissions, and 0% in draws, DQs, Physician ended fights, KOs	23.6/100 fight participations, loser 2.4× more likely to be injured
Rainey [23]	2009	Retrospective cross-sectional study	Survey	NA/55	NA/94.5% male	207	47 (22.7%)	16.2% Strains	NA
							Shoulder: 13 (6.2%)		
							Finger: 9 (4.3%)	14.9% Sprains	
							Elbow: 7 (3.4%)	10.1% Abrasions	
							Upper Arm: 6 (2.9%)	9.2% Joint Trauma	
							Hand: 6 (2.9%)	5.7% Fracture	
							Wrist: 4 (1.9%)	5.3% Lacerations	
								2.6% Dislocations	

Scoggin et al. [26]	2010	Prospective Cohort	Hawaiin MMA competitions from 1999–2006	116/179	Not specified	55/49	8 (14.5%)	1 lateral sprain, 1 medial sprain, 1 subluxation and 1 olecranon bursitis	0.237 injuries per exposure
							Elbow: 4 (7.3%)		
							Metacarpal: 3 (5.5%)	1 fracture, 2 other injuries	
							AC joint: 1 (1.8%)	Separation	
Diesselhorst et al. [32]	2013	Retrospective Cohort	Survey of 758 participants of martial arts regarding upper extremity injuries (38% participating in "multiple martial arts" though included MMA)	NA/758	44 years, 81% male	NA	Hand/Wrist/ Fingers: 53% injured	Sprains/Muscle Strains: 47%	NA
							Shoulder/Upper Arm: 27%	Abrasions/Bruises: 26%	
							Forearm/Elbow: 19%	Fracture of upper Extremity: 39%	
								Dislocation: 47%	
Otten et al. [25]	2015	Retrospective Cohort	NSAC (UFC events 2007–2009) Divided into Figher Complaints and Doctor Observations	152/304	NA/100% Male	170 fighter complaints, 91 Physician Observations/120 (based on counting presented data)	*Fighers Complained of:*	*Doctors Noted:*	39.7/100 competitors
							29 (17.1%)	Lacerations/Soft tissue injuries: 58 (63.7%)	
							Hand and Wrist: 15 (8.8%)	Shoulder: 4 (4.4%)	
							Arm/Elbow: 7 (4.1%)	Hand: 3 (3.3%)	
							Shoulder: 7 (4.1%)		

(continued)

Table 7.2 (continued)

Paper	Year	Type of study	Source of information	Number of matches/ fighters	Average age/ gender	Number of injuries/ fighters injured	Number of upper extremity injuries (percent of total injuries)	Types of injuries (not specific to upper extremity injuries unless specified)	Overall injury rate
Karpman et al. [36]	2016	Consecutive case series, observational cohort	MMA bouts in Edmonton 2000–2002 and 2005–2013	1181 fighters	NA/99% male	926/702	Only injury specific to body part was fracture: Hand/ arm fractures: 29 (49.2% of fractures recorded)	Contusion: 663 (56.1%)	59.4% overall injury rate
								Concussion: 98 (8.3%)	2.5% of which were hand/arm fractures
								Laceration: 95 (8.0%)	
								Fracture: 59 (5.0%)	
								Eye injury: 3 (0.3%)	
								Dislocation: 2 (0.2%)	
								Other: 6 (0.5%)	
Ji [24]	2016	Retrospective cohort	Survey of 470 MMA athletes Seoul or Gyeongnam province, Korea between 6/2015 and 11/2015	455 fighters (15 surveys excluded)	62.4% between 20 and 29 years/96.3% Male	860/455	Arm: 253 (30.4%)	Laceration: 321 (37.3%)	NA
							Hand: 71 (8.5%)	Concussion: 179 (20.8%)	
							Wrist: 65 (7.8%)	Contusion: 142 (16.5%)	
							Shoulder: 37 (4.5)	Fracture: 53 (6.2%)	
							Forearm: 25 (3%)	Strain: 51 (6.0%)	
							Finger: 15 (1.8%)	Joint: Dysfunction: 45 (5.2%)	
							Elbow: 3 (0.4%)	Sprain: 25 (2.9%)	
								Dislocation: 20 (2.3%)	
								Epistaxis: 15 (1.8%)	
								Other: 9 (1%)	

Pomerantz [22]	2017	Retrospective cohort (not published)	Survey of 93 respondents	93 fighters	79.3% between 20 and 35 years/90.3% Male	215/93	Arm: 59 (27.4%)	Laceration: 5 (5.8%)	NA
							Shoulder: 37 (49.3%)	Concussion: 25 (11.6%)	
							Elbow: 22 (29.3%)	Neck Strain: 24 (11.2%)	
							Hand: 6 (8.0%)	Fracture: 9 (4.2%)	
							Finger: 6 (8.0%)	Strain: 11 (5.1%)	
							Wrist: 2 (2.7%)	Lost Tooth: 7 (3.3%)	
								Sprain: 57 (26.5%)	
								Other: 4 (1.9%)	

injuries in MMA. An additional article was found through references pertinent to the research topic, and another article is pending; submission by the author of this paper and its data is included. Table 7.2 summarizes the findings of these studies.

In the articles reviewed, three articles were based on results from surveys of fighters. In those studies, the percentage reporting injury to the hand and wrist occurred at 9.2% [23], 17.6% [24], and 17.7% [22]. In four observational/record review studies, the rates are 5% [25], 5.5% [26], 12.0% (Nevada State Athletic Commission 2001–2009 as reported by Lystad, et al. [27]), and 13.5% [28]. Another study [32], only looking at upper extremity injuries, noted that 53% of martial artist survey respondents reported upper extremity injuries were to the hand/wrist. Two other studies were not more specific than "arm/hand" [36] or "upper limb" [35], and therefore rates of injury to the hand and wrist could not be assessed in these articles.

Unfortunately, only one article mentions specific injuries to the wrist, hand, or finger in MMA: three metacarpal injuries including one confirmed fracture [26].

Given the heterogeneity of the structure and results of these studies, meta-analysis was not possible.

7.5 Discussion

There is a paucity of published data on injuries in MMA, with even less described for hand and wrist injuries. The studies that exist are limited level 4 studies. The available research shows hand and wrist injury rates of 5–17.7% in MMA. Hand and wrist injuries reported for other martial arts are also limited but include 6.5–17% [6, 15–17] for boxing, 2.1–2.9% [18, 19] for Muay Thai kickboxing, 3.0–12.5% [12–14] in karate, 8–10.8% in taekwondo [7, 20, 21], 3.5–13.4% in wrestling [6, 8–10], 6–30% [5–7] in judo, and 11.1% [11] in Brazilian (Jiu Jitsu). From the limited research, it does not seem that MMA has a higher predilection to hand or wrist injury than other combat sports. This conclusion is also corroborated in a recent review of literature for several martial arts [37].

As previously mentioned, the specific types of injuries sustained in MMA are essentially without description in the literature. There are case examples available to review, and we can make educated guesses on the types of injuries that may occur based on other martial arts. All things considered, from a hand and wrist injury viewpoint, the striking component of MMA is most similar to karate or taekwondo. However, many MMA fighters have trained in boxing or kickboxing and may have habits and training methods conducive to boxing or kickboxing. As opposed to boxing, karate and taekwondo have a combination of striking with hands and feet, with different angles of of strikes being used and with small gloves. For less experienced MMA competitors, especially those with experience in boxing or kickboxing, there may be an even higher risk of injury as they have not adapted to the needs of MMA. Finger joint sprains/dislocations in karate are common including thumb MCP joint injuries [12, 38], and one study [38] attributed it to open-hand strikes or catching fingers within the uniform. The most common fracture observed in karate was a fracture of the neck of the second metacarpal [39], but first metacarpal base fractures were also noted. As cited before, Noble [31] described many thumb MCP joint UCL injuries in boxers when the gloves had an independent thumb. Other injuries he noted were various fractures about the thumb, two scaphoid fractures, injuries to the carpometacarpal joints of the hand including dislocation, metacarpal fractures, and several proximal phalanx fractures [31]. Other boxing injuries described include radiocarpal strains, dislocations or tears of the extensor digitorum communis, and extensor carpi radialis and brevis tears [31, 40].

MMA has additional possible injuries from grappling like those that may be seen in judo, wrestling, or Brazilian Jiu Jitsu. Unfortunately, there is not much described research on the specific injuries in these sports either. Specific injuries described for a single Brazilian jiujitsu tournament [11] include distal interphalangeal joint sprain, thumb sprain, PIP joint dislocation, and ring finger metacarpal fracture. Many injuries to the fingers in

judo are attributed to being thrown but also to gripping the uniform [5, 41]. Most of these injuries were sprains and strains or "soft" injuries [5]. FDP avulsion injuries, mallet fingers, and various sprains and strains in the hand have been described in judo [5–7, 41], and a case report of a dorsal distal radioulnar joint dislocation exists [42]. Wrestling hand injuries include many sprains of finger joints including the thumb MCP joint [6, 10], but fractures have been reported [8, 9].

Through this review, in addition to personal experience and observation, it is clear that MMA presents risk of injury to the hand and wrist. This is by the nature of the sport as well as the gloves the competitors wear. While grappling is a large component of MMA, fractures as a result of impact are more likely to occur in MMA as opposed to isolated grappling sports like judo, Brazilian jiujitsu, or wrestling. Unlike boxing or kickboxing, the thumb is exposed during punching, which could result in injuries from direct impact or from being deviated. Also, compared to boxing or kickboxing, where punches are less angled, the strikes in MMA are more similar to arts like karate where strikes come from many different angles and impact the hand differently (Fig. 7.5a–c). The angled punching required in certain situations will focus energy more on the radial or ulnar aspects of the fist resulting in a different injury profile. The gloves themselves contribute to injury as they have independent fingers to help with grasping the opponent but also allow for potential twisting and shearing of the fingers. Additionally, with the gloves ending at the PIP joints resulting in relative deceased range of motion proximally, there are increased forces that the PIP joints experience, which I feel increases the likelihood of PIP dislocations. Multiple PIP dislocations are documented on publicly available photographs on the Internet. The small gloves also result in increased forces to the hand during a punch or while defending strikes, which can result in increased exposure to injury of the hand and wrist. Injuries from the fight area or uniform/apparel other than the gloves appear to be a small contributor to hand and wrist injuries in MMA.

The nature of researching this type of injury profile will continue to be based on surveys which are subject to recall biases by those surveyed, record reviews which are limited in scope and information, and direct observation which has its own limitations in study size, observer biases, and logistical issues such as follow-up. Future research will need to focus on determining the specific injuries and their causes. This will help in the prevention of injuries including possible new designs for the gloves and changes in fight area construction. Additionally, it will help the medical personnel who care for these athletes to better anticipate injuries and treat them.

At this point, we as surgeons of the hand and wrist can expect to see more patients involved in the sport of MMA with injuries similar to other fighting arts but with possibly different injury patterns. Their treatment will also be similar, as the goals will remain the same. These athletes will be as motivated to return to sport as any other athlete and can be expected to take the steps necessary to assure optimal outcome.

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