

Injury rates in Shotokan karate

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Abstract

Objective—To document the injury rate in three British Shotokan karate championships in consecutive years. In these tournaments strict rules governed contact, with only “light” or “touch” contact allowed. Protective padding for the head, hands, or feet was prohibited.

Methods—Prospective recording of injuries resulting from 1770 bouts in three national competitions of 1996, 1997, and 1998. Details of ages and years of karate experience were also obtained.

Results—160 injuries were sustained in 1770 bouts. The overall rate of injury was 0.09 per bout and 0.13 per competitor. 91 (57%) injuries were to the head. The average age of those injured was 22 years, with an average of nine years of experience in karate.

Conclusions—The absence of protective padding does not result in higher injury rates than in most other series of Shotokan karate injuries. Strict refereeing is essential, however, to maintain control and minimise contact.

(Br J Sports Med 1999;33:174-177)

Keywords: protective padding; injuries; martial arts; karate

Karate is one of the most popular martial arts and the word “karate”, meaning empty hand (kara = empty, te = hand), describes the fact that karate involves the use of kicks, punches, and blocking techniques without the use of weapons. Shotokan karate is one of the oldest styles of karate and was first publicly demonstrated in Japan in 1922 by its modern day founder Gichin Funakoshi, though it had flourished on the Japanese island of Okinawa for at least 400 years before that.¹ In Great Britain Shotokan karate is practised by more people than any other style, and the Karate Union of Great Britain is the largest single karate organisation in Great Britain with around 12 000 members. Karate training has three main aspects: “kihon” are basic techniques which are practised without an opponent; “kata” are set combinations of techniques which again are practised without an opponent; “kumite” is the term used for sparring with an opponent and ranges from prearranged

moves for beginners to “free fighting” for experienced practitioners and for use in competitions.

The emphasis in any competitive sport is on excellence of performance coupled with the safety of the participants. Injuries in martial arts competitions, including karate competitions, have been extensively reported¹⁻⁶ and recommendations made on the basis of these reports.⁶⁻⁸ The martial arts are a heterogeneous group of disciplines and even for the practice of karate there are different codes with different rules of engagement within competitions. Modern karate tournaments may be classified into five types according to the degree of contact allowed: light or touch contact; semi-contact; knock down with no full contact strikes to the head; knock down with full contact strikes to the head; and full contact.¹⁻⁹ In full contact karate, punches and kicks are allowed to make full contact with the opponent's body. In light or touch contact tournaments, kicks and punches are still delivered with full force but are controlled such that they stop just before contact with the opponent's body. Light contact is permissible to the trunk and no more than skin touch allowed to the head and face. If excessive contact is made then warnings and disqualification result. Shotokan karate competitions as held by the Karate Union of Great Britain are of this latter type and protective padding is not worn.

This study aimed at determining the injury rate in the national competitions of the Karate Union of Great Britain and the pattern of these injuries compared with those previously reported.

Methods

Injuries sustained at the national championships of 1996, 1997, and 1998 are reported. All competitors were required to wear mouth guards and groin or chest guards depending on sex. There were separate competitions for men, women, men aged 17-21, boys aged 10-11, boys aged 12-16 under 5 foot tall (152 cm), boys aged 12-16 from 5 foot to 5 feet 5 inches (165 cm) tall, and boys aged 12-16 over 5 feet 5 inches tall. No padded headgear, hand protection, or foot protection was allowed. Competition bouts took place on padded competition areas. All championships were supervised by at least three doctors of varying disciplines, most of whom practise karate and had

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Accepted for publication
18 January 1999

Table 1 Number of contests and number of competitors

| Year | 1996 | 1997 | 1998 | Total |
|-------------|------|------|------|-------|
| Total bouts | 641 | 584 | 545 | 1770 |
| Competitors | | | | |
| Male | 235 | 219 | 191 | |
| Female | 71 | 65 | 68 | |
| Under 16 | 159 | 144 | 121 | |
| Total | 465 | 428 | 380 | 1273 |

competed in the competition previously. Members of St John's Ambulance were also in attendance.

Injuries presented in two ways. Firstly, competitors could present themselves to a treatment area, which was separate from the competition mats. Secondly, competitors who sustained injuries on the mats were transferred to the treatment area. When an injury occurred in competition the referee asked one of the doctors for an assessment. The bout was then stopped, the nature of the injury assessed, and treatment given if necessary. A decision was made as to whether the competitor could stay on the mat and continue or whether he needed to be transferred to the treatment area. After treatment, the doctor then decided whether the competitor could continue in the competition.

The site and nature of the injuries and the treatment given by the doctor were recorded. Details of the age, sex, and experience of the person injured were also recorded. Table 1 shows the numbers of bouts. Each bout lasted for two minutes with a maximum score of one point or two half points finishing the contest. One minute extensions occurred when bouts were drawn. Table 2 categorises the injuries sustained.

Results

One hundred and sixty injuries were recorded in the 1770 bouts, giving an incidence of 1 in 11 bouts or 0.09 injuries per bout. There were 1273 competitors, giving a rate of 0.13 per competitor. Table 2 shows the distribution of injuries. Ninety one (57%) injuries were to the head, followed by 60 (37.5%) limb injuries. Most facial injuries were through blows to the malar regions. Facial fractures, of which there were five, comprised three fractured noses, which were immediately reduced, one fractured mandibular ramus, and one blowout fracture of the inferior orbital margin. Limb fractures or dislocations were one patella dislocation, one humeral fracture, and two digit fractures, one of which was associated with a

Table 2

| Injuries | 1996 | 1997 | 1998 | Overall |
|------------------------|------|------|------|---------|
| Head | | | | |
| 1 Laceration/contusion | 18 | 29 | 26 | 73 |
| 2 Concussion—no LOC* | 5 | 3 | 3 | 11 |
| 3 LOC* | 0 | 1 | 0 | 1 |
| 4 Facial fracture | 2 | 1 | 2 | 5 |
| 5 Traumatic mydriasis | 0 | 1 | 0 | 1 |
| Torso | | | | |
| 1 Bruising | 3 | 5 | 1 | 9 |
| Limb | | | | |
| 1 Arm injuries | | | | |
| Laceration/contusion | 6 | 8 | 5 | 19 |
| Fracture/dislocation | 1 | 3 | 0 | 4 |
| 2 Leg injuries | | | | |
| Laceration/contusion | 11 | 13 | 12 | 36 |
| Fracture/dislocation | 1 | 0 | 0 | 1 |
| Total | 47 | 64 | 49 | 160 |

*LOC = loss of consciousness.

Table 3 Overall rates of injury

| | |
|-----------------------------|------|
| Overall rate per bout | 0.09 |
| Rate per competitor | 0.13 |
| Rate per adult male | 0.13 |
| Rate per adult female | 0.10 |
| Rate per under 16 year old | 0.11 |
| Average age of injured | 22 |
| Average years of experience | 8.9 |

proximal interphalangeal joint dislocation and one with a fifth metacarpal fracture. The competitor who lost consciousness after a blow to the head was transferred to the local accident and emergency unit and was released later that day. Patients who were concussed without loss of consciousness were observed in the treatment area for a minimum of 15 minutes.

Six competitors who had "had their bell rung" but rapidly recovered with no further symptoms of dizziness, headache, nausea or amnesia and no neurological signs were allowed to return to the event. Five further competitors were not allowed to continue and were given instructions about further training.¹⁰ Table 3 summarises the overall rates of injury.

Discussion

The treating doctors had competed in the competitions in previous years and thus were known to the referees and rapidly consulted if necessary. All injuries, however minor, were recorded and in some cases this included injuries for which medical attention would not have been sought if sustained during routine club training. The results can therefore be considered a good representation of the number of injuries.

Although the pattern of injuries is similar to those of other reported series,¹ the relative rate of injury to the head and face is a cause for concern. As these are serious or potentially serious injuries the emphasis should be on education and control by competitors and referees to reduce these further if possible.

The rate of injuries in this study compares favourably with those previously reported in similar Shotokan karate tournaments. Tuominen reported a rate of 0.28 injuries per bout from 450 bouts in which hand padding was mandatory.¹¹ Johannsen and Noerregaard reported an injury rate of 0.26 per bout in 290 bouts in which hand padding was worn and a rate of 0.25 injuries per bout in 620 bouts in which padding was not worn.³ Stricevic *et al* reported an injury rate of 0.3 injuries per match from 309 matches in which padding was not worn.¹ McLatchie (1977) reported a rate of 0.20 injuries per bout in 744 contests ranging from regional tournaments to international competitions.⁴ In these tournaments no padding was worn. After the introduction of hand, foot, and head padding worn by 75% of the competitors the rate of injury was reduced to 0.04 per bout in 1102 bouts. These results were summarised over 10 years from 1974 to 1983 in 13 566 bouts in which the injury rate dropped from 0.25 per bout in 1974–76 to 0.05 per bout in 1980–83.⁶ Injury rates from martial arts tournaments which are not of the

light contact form are much higher. McLatchie (1980) reported 37 out of 70 competitors sustaining an injury during knock down Kyokushinkai tournaments.⁵

A number of factors have been identified in preventing injuries. One of the first must be having medical personnel present who can not only treat injuries but also identify contributing factors to the injury. The second is an emphasis on discipline by competitors taking part in a potentially dangerous sport and the strict enforcement of the rules by the referees. Other factors include the use of padded flooring, thus minimising second impact injuries to the head if a competitor is knocked backwards and falls. The stratification of competitors by age, height, or weight minimises mismatches. The use of mouth guards and groin guards protects against local injury. These changes and the use of protective knuckle pads, shin pads, and foot pads were felt by McLatchie⁶ to contribute to the reduction of injury from 0.25 to 0.05 per bout, though the relative contribution of each factor is unclear.

Many schools of karate feel that to wear protective padding would detract from the discipline of karate practice. As most injuries to the limbs are caused by poor techniques, punching or kicking opponent's bony prominences,³ padding is usually perceived as protecting the attacker rather than the person hit. This might lead to a reduced emphasis on control and a greater number of blows to the head being delivered with greater force. Johannsen and Noerregaard reported a greater incidence of head injuries from those tournaments where hand padding was worn, together with a reduction in hand injuries.³

The role of protection in reducing the impact of the blow has been considered by a number of authors under experimental conditions. Schwartz *et al* compared the effect of hand and foot protection on the forces imparted to a dummy's head.¹² Fourteen karate experts punched and kicked the dummy's head with maximum force with and without hand protectors and foot padding. Ten ounce boxing gloves did reduce peak accelerations to some extent, but a form of knuckle protection did not. Foot protection increased peak accelerations imparted to dummies. The authors concluded that violent acceleration of the head by any means produces injury, and thus boxing and full contact karate with or without padding will lead to the same pattern of injuries.

Schmid *et al* tested the efficiency of headgear by simulating a blow with a suspended punching ball weighing 2.45 kg striking the head with a velocity of 4.7 m/s.¹³ The use of headgear reduced peak accelerations by about 15–25%. Feld *et al*, though, measuring karate strikes, described peak speeds for forward punches of 9.8 m/s and for kicks of 14.4 m/s.¹⁴ These speeds are somewhat greater than those used by Schmid *et al*, and therefore further studies are needed to determine the effectiveness of headgear.

Although it is unclear whether serious brain injury is affected by the wearing of head guards, foot and hand padding, in the reports

from Schmid *et al*,¹³ Johannsen and Noerregaard,³ and McLatchie and Morris⁴ there is a reduction in superficial injuries for the defender, such as eyebrow cuts and facial bruising. The BMA report on boxing states "Head guards undoubtedly protect against superficial injury to the face, eyebrows, and ears but cannot eliminate the dangerous accelerating and decelerating forces applied to the head."¹⁵ Gloves are designed to protect the fists of the wearer and do nothing to prevent brain injury unless they are so large as to be unwieldy." It appears likely that headgear and foot and hand padding may reduce superficial cuts for the recipient of the blow but will not prevent the immediate or long term effects of brain injury.

The role of strict refereeing and competitor discipline in reduction of injuries has been commented on by a number of authors^{3 6} and in the tournaments reported here is likely to be the principal factor controlling injury rates.

Conclusions

A rate of 0.09 injuries per bout over 1770 bouts is comparable with the results of other studies of light or touch contact karate. The initial reduction of karate injuries by the introduction of protective padding, as reported by McLatchie, has not been reproduced elsewhere and may represent other safety measures. Although there is evidence that hand protection protects the attacker from hand injuries and with headgear protects the defender from facial contusions, there is insufficient evidence that protective padding protects against brain injury in either the long or short term. Indeed, protective padding can lead to an increase in the frequency and force of contact. Thus we do not feel it necessary at present to recommend protective padding for the face or hands for Shotokan karate tournaments. The relatively low injury rate reported here can only be sustained by strict refereeing, a high standard of training of referees and competitors, and strict enforcement of rules of contact. Continuous medical surveillance by doctors with an understanding of karate is necessary.

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Take home message

- Medical supervision is necessary at all karate competitions.
- Strict refereeing and good competitor discipline are important factors that can minimise injury rates in the “controlled combat” of karate competitions.

Commentary

This paper serves to illustrate a number of points well known to participants in contact sports and doctors involved with the sports but not necessarily by the public and the media. Firstly, injury is rare and significant injury even rarer. The meticulous recording of injuries, as has been presented here, is an important aspect of medical care in sports, but not always carried out in some sports. Secondly, protective padding does not necessarily protect and can increase the risk of injury by giving a false sense of security. Thirdly, and most importantly, prevention of injury is the most important aspect of care, and the best way of ensuring this is by strict application of the rules by trained, experienced, and firm referees. Other sports where the referees are under increasing external scrutiny and pressure would do well to take note.

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British Association of Sport and Medicine in association with the National Sports Medicine Institute

Education programme 1999

All courses consider aspects of sports medicine other than injury. The number of delegates on these courses is limited.

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| Intermediate Sports Injury Course—Part 2 Lilleshall Hall National Sports Centre, Shropshire (residential) | 11–16 July |
| General Sports Medicine Course Lilleshall Hall National Sports Centre, Shropshire (residential) | 19–24 September |
| Practical Sport and Medicine Course Club La Santa, Lanzarote (residential) | 7–14 October |
| BASM National Congress: (Northern) Gosforth Park Hotel, Newcastle | 21–24 October |
| Advanced Sports Medicine Course (new) Lilleshall Hall National Sports Centre, Shropshire (residential) PGEA and CME will be sought | 24–29 October |
| Intermediate Sports Injury Course—Part 1 Lilleshall Hall National Sports Centre, Shropshire (residential) | 21–26 November |

For further details of these courses and for details of the 2000 provisional education programme please contact Mr Barry Hill, The National Sports Medicine Institute, c/o Medical College of St Bartholomew's Hospital, Charterhouse Square, London EC1M 6BQ. Tel 0171 251 0583 (ext 237). Fax 0171 251 0774.

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