

## A survey of croquet injuries

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### SUMMARY

**Of 214 croquet players who responded to a questionnaire, 76 reported at least one injury to hand, wrist or forearm caused by striking the ball. There was no obvious relation to which of the three main grips the player applied to the mallet. Injuries were somewhat more frequent when the mallet shaft consisted of fibreglass than when it was wood, metal or carbon fibre, but a causal relation has not been established. Back injuries seem less troublesome in croquet than in golf.**

### INTRODUCTION

Many sports lead to injury and where the object is to strike a ball with an implement (bat, racquet, stick, club) the injury will often be to hand, wrist or forearm; croquet is no exception. A croquet mallet weighs about three pounds (1.25 kg) and is used to strike one or two balls each weighing one pound; a single ball may have to travel more than 40 yards (35 m) and each of two balls may be required to move more than 20 yards (17.5 m). On a slow lawn such distances may be beyond some players' physical capabilities. During a season a croquet enthusiast may play twenty thousand strokes, and one of them or an accumulation may lead to injury. Lamb<sup>1</sup> says 'the Irish grip can put a great deal of strain on the wrists'.

The three main grips used are illustrated in Figure 1 by the three leading English players in a recent international match. They all keep their hands together for single-ball strokes; others do not. Figure 1(a) shows the 'standard' grip in which the little finger of the top hand is below the other fingers while that of the bottom hand is the top one. Figure 1(b) illustrates the 'Irish' grip in which both little fingers are above the other fingers on the same hand, and Figure 1(c) is an example of the 'Solomon' grip in which the little fingers of each hand lie below the others. For many two-ball strokes the grip is changed so as to adjust the relative distances the balls travel, and Figure 1(d) shows a grip adopted by the player in Figure 1(a) for a 'half roll' (that is a stroke in which topspin is imparted to the ball struck so that it travels half as far as the ball which it itself propels; without such spin it would move only a quarter or a third as far as the other ball if they were sent in the same direction). Also, the hands may be rotated: Figure 1(e) shows the Irish grip of the fourth player in the team, and it is clear that the stresses on his wrists in swinging the mallet and striking the ball will differ substantially from

those in the player in Figure 1b. Photographs exemplifying the standard grip in popular croquet books<sup>1,2</sup> are quite different from each other.

A survey has been conducted among club croquet players to catalogue the injuries and to see whether different types of mallet shaft or different ways of holding it predispose to injury. In addition, accidental injuries sustained while playing, but not as a result of striking the ball, have been investigated. Other possible influences, such as the type of balls used, the material forming the striking faces of the mallet, or the length of the shaft, were thought either less relevant or too difficult to ascertain accurately.

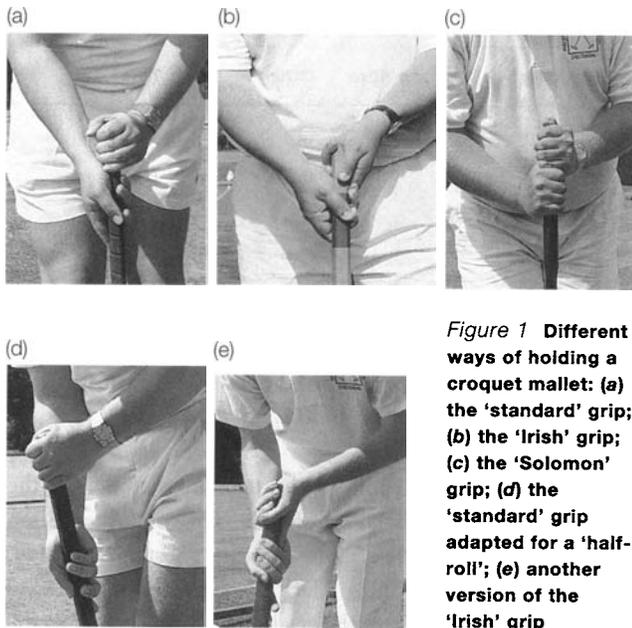
### METHODS

A pilot questionnaire was sent out with the *Bulletin* of the Scottish Croquet Association and replies were received from 46 individuals. Injuries were reported by 12. About two-thirds of players used the 'standard' grip, and if 20% of them were to suffer injuries, and 40% of those with other grips were to do so, then a study with 250 respondents would have a power of 90% to detect the differences as significant at the 5% level in a two-tailed test.

As a result of players' responses a slightly modified questionnaire was then distributed via the *Gazette* of the (English) Croquet Association, which has a circulation about 10 times larger than the *Bulletin*. The number of seasons each player had used each kind of mallet was determined and other details were recorded about the player's age, sex, experience and ability. An injury was categorized as 'minor' if treatment had not been required and the player no longer had any pain or inconvenience from it, and otherwise as 'discommoding'.

### RESULTS

Replies were received from 214 UK players (169 men, 45 women). Mean age at starting to play was 44 for the men



**Figure 1** Different ways of holding a croquet mallet: (a) the 'standard' grip; (b) the 'Irish' grip; (c) the 'Solomon' grip; (d) the 'standard' grip adapted for a 'half-roll'; (e) another version of the 'Irish' grip

and 50 for the women. Total playing time was 2130 seasons. 76 players (36% men, 38% women) reported at least one injury to hand, wrist or forearm caused by striking the ball. 43 players had injuries classified as discommoding. Most of them were 'wrist sprain' but occasionally they were described as 'tennis elbow', 'tendonitis', 'tenosynovitis', 'carpal tunnel syndrome' or 'trigger finger'; there was one dislocated wrist. 25 players put the injury down to playing on slow lawns or the like. Many of the disorders were said to have developed over time.

Table 1 shows the injuries to wrist, hand and forearm classified according to the player's normal grip for single-ball strokes, and by severity. There is no significant association between grip and the frequency either of any such injury ( $\chi^2=0.29$ ;  $P=0.87$ ) or of discommoding injury ( $\chi^2=1.50$ ;  $P=0.47$ ). No association was found with whether or not the hands were held together or apart, nor was the site of the injury (upper or lower hand) related to grip.

Table 2 shows the same injuries classified by the type of mallet shaft being used at the time. Expected frequencies are based on the numbers of seasons (out of the total of

2130) each type was used. There is a significant association ( $\chi^2=8.32$ ;  $P=0.040$ ), fibre glass shafts being worst. A similar but non-significant pattern is seen if only discommoding injuries are counted. Other disorders requiring treatment included five cases of ankles or shins struck with the mallet, and three injuries, including a hernia, caused by using 'side style' (playing a stroke with the ball outside rather than between the feet). Back or neck pain was reported in 14 cases.

The most serious injuries were caused by accidents not connected with playing strokes. Falling as a result of standing on a ball had the worst effects, including a broken wrist, torn foot ligaments necessitating elbow crutches, and cracked ribs. Other falls, over court borders, hoops or mallets, led to broken or sprained ankles; a woman with Schamburg's disease (osteopetrosis<sup>3</sup>) broke a femur, two ribs and a collar bone in one such incident. One player suffered a black eye from being struck on the head by a mallet while refereeing a stroke (in the pilot study a referee was reported to have been rendered unconscious in a similar accident). One player broke a bone in her foot putting on a Wellington boot. 14 people mentioned sunburn as troublesome.

**DISCUSSION**

In 1996 there were 1333 registered associates of the Croquet Association. A response of 214 therefore represents only 16% of the membership and I cannot regard this survey as offering any definitive results on the prevalence of injury among croquet players in general.

Nevertheless, a good cross-section was obtained in terms of age and ability and the three main grips and four types of mallet shafts were adequately represented. Our inability to demonstrate an effect of grip needs to be treated with caution: the sample obtained was smaller than that required by power calculations, players change their grips for different strokes, they may have chosen a grip because they saw it as less likely to cause injury, and the categorization used is not particularly useful in this context since quite different stresses can be involved because of rotation of the hands round the shaft. If further work is to

**Table 1** Relationship between grip and severity of injury of hand, wrist or forearm

Grip	No injury	Minor injury	Discommoding injury	Total
Standard	96 (65%)	23 (16%)	29 (20%)	148
Irish	13 (59%)	6 (27%)	3 (14%)	22
Solomon	24 (63%)	4 (11%)	10 (26%)	38
Other or don't know	5	0	1	6
Total	138 (64%)	33 (15%)	43 (20%)	214

Table 2 Relationship between type of mallet shaft and injuries of hand, wrist and forearm

Type of shaft	Wood	Metal	Fibreglass	Carbon fibre	Other	Total
Observed number of injuries	40	12	15	4	5	76
Expected number of injuries	48.0	9.3	8.1	5.7	(5)	76
Risk relative to wood (with 95% confidence interval)		1.6 0.7-3.0	2.2 1.2-4.1	0.8 0.2-2.3		

be done, a detailed analysis of the movement of the wrists during the swing and striking period is probably required.

The implication that fibreglass shafts tend to increase the likelihood of wrist injury may be real, but only half of the players surveyed had kept to one kind of mallet throughout their croquet-playing career, and it is possible that some had moved to fibreglass in an attempt to compensate for a perceived tendency to jarring with another kind of mallet. The result is also very sensitive to individual results: if even one player had reported an injury as occurring with a carbon fibre shaft instead of a fibreglass one the *P*-value would have more than doubled.

No relationship could be found between propensity to injury and the amount of play or practice a player engaged in. Those prone to injury may of course restrict the amount they play. Although serious players may accept the risk of discommoding injury, coaches should make sure that beginners are aware that they may get wrist troubles. Unfortunately it is not yet clear what advice they should give to help players reduce the risk of injury, except to emphasize that some shots are best not played on slow lawns.

Back-pain featured very little considering the age distribution of players and croquet was seldom implicated more strongly than aggravating an existing disorder. This contrasts with golf, where a group of similar age and sex structure suffered injuries to the back as well as to hand, wrist and forearm<sup>4</sup>. Injuries caused by falls could be quite

serious, the worst ones being associated with extra balls on a court being used simultaneously for two games.

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