

Injuries on British climbing walls

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A postal survey was carried out of the 90 most accessible climbing walls in England, Scotland and Wales to determine the incidence and nature of injuries requiring emergency treatment associated with their use. Over a two year period, representing 1.021 million visits to the 56 walls used by more than 30 climbers per week, 55 significant injuries were recorded. The rate of injury was not related to any identified design or safety feature of the walls, although upper limb injuries were proportionally more common in walls which provided thinner fixed landing mats rather than thicker, moveable crash mats. The overall rate of injury was very low and climbers seem to modify risk taking behaviour and thus compensate for the level of safety equipment available. It may be possible to reduce the injury rate further by providing seamless ground cover with matting of adequate energy absorbency.

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The explosion of interest in rock climbing has led to the emergence of climbing walls in many towns and cities (Figure 1), allowing all weather access to an environment where the technical moves involved in the sport can be practised. Rock climbing is generally regarded as a dangerous sport, although this depends to a large extent on personal risk taking behaviour. Many of these walls permit climbing without ropes or other safety equipment, and this study set out to investigate the incidence of major injuries on these particular facilities.

Methods

A postal survey was targeted at the 90 most accessible walls in England, Scotland and Wales.¹ This survey requested details of the construction of the wall, safety features and equipment, and the climbing styles allowed (for example, soloing is climbing without ropes; leading is paired climbing with the leader clipped into anchor points as he or she progresses; and top-roping is paired climbing with the rope running through a belay at the top of the wall, slack being taken in as the climber ascends). A record of significant injuries occurring in the two year period from July 1991 to July 1993 was also requested. A significant injury was defined as one requiring the injured party to be transported to a local casualty department for emergency treatment. Thirteen

of the walls (23%) were visited after receipt of the completed questionnaire to check on the accuracy of reported data.

The information was compiled onto a computer database, the analysis of which is presented in this report.

Results

Of the 90 walls identified, 68 were recorded as having very good access and 22 poor access (for example, because the wall was situated in a sports hall and could not be used at the same time as other facilities in the hall without interference, thus limiting the availability of the wall). Sixty two replies were received (overall response rate 69%), 56 from centres with very good access (response rate in this group 82%).

The number of climbers using the walls per week varied from an average of one (for one of the walls with poor availability) to over 2000 (for the most popular wall, as an average over the two year period). In view of the small number of climbers using some of the walls with poor access, these walls were excluded from further analysis. The 56 walls with good access were all used by at least 30 climbers per week. From the annual attendance rates it was calculated that in the two year period under investigation, 1.021 million visits were made to these 56 walls.

A total of 55 significant injuries was reported and these are summarized in Table 1. A larger number of minor injuries were recorded, but are not considered in this analysis.

A relation between the various safety features and climbing styles and the observed injury rates was made. No relation was found between wall height and injury rate, nor was the injury rate any lower in the few walls that did not allow climbers to solo but insisted on the use of ropes. Thirty five per cent of the walls were designed exclusively for soloing and 32% of injuries occurred on these walls. Similarly, those walls which imposed restrictive regulations regarding the use of equipment and the presence of an instructor did not have a lower injury rate.

The provision of safety mats did not influence the injury rate, but did seem to have some influence on the pattern of injuries. A larger proportion of upper limb injuries (11/14) occurred on those walls which provided fixed safety mats at the base of the wall rather than moveable mats which required repositioning by the climber. Assuming an expected equal proportion of

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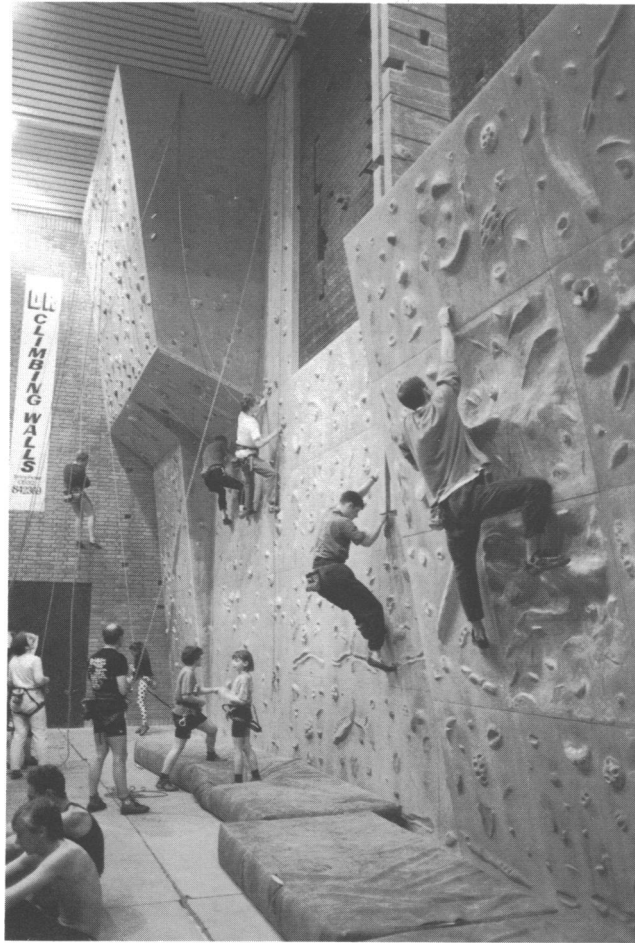


Figure 1.

Table 1. Injuries recorded on British climbing walls July 1991–June 1993

Injury	Number
Ankle fracture	19 (1 bilateral)
Ankle sprain	14
Wrist fracture	2
Wrist sprain	1
Forearm fracture (children)	2
Forearm fracture (adult)	2
Shoulder dislocation	6
Calcaneal fracture	2
Tibial fracture (open)	1
Knee ligamentous injury	1
Back sprain	3
Elbow fracture	1
Elbow dislocation	1

upper limb injuries when comparing landing surfaces, this observed excess is significant ($\chi^2 = 4.57$, $P < 0.05$). There was a higher injury rate on walls providing fixed mats, but this did not itself reach statistical significance. The average thickness of fixed mats or cushioned flooring was 7.2 cm, while that of the moveable (crash) mats was 35.8 cm.

On visiting the walls, data regarding mat size, thickness and position were found to be accurate in all

cases (sketch maps being provided by all wall owners as requested), as were other data concerning wall construction and climbing styles practised. It was not possible to verify injury data as these were reviewed retrospectively, although accurate records seemed to have been kept.

Discussion

Climbing is considered a high risk sport, and previous studies have highlighted a high incidence of serious injuries, although these tend to occur in association with snow and ice climbing and mountaineering.²

Reports on rock climbing injuries have concentrated on the soft tissue problems that arise as a consequence of participation at the elite end of the spectrum and the training that this involves, or the specific hand injuries that occur in competition climbers.^{3–9}

Climbing walls are now appearing in many towns and cities, with new walls opening every month. These are usually freely available to the public and have a variable availability of landing mats and other safety equipment. However, it seems that risk taking behaviour is modified to account for this—those walls with concrete floors and no facilities for roped climbing having a similar accident rate to those with extensive safety mats and regulations requiring the use of ropes.

Paradoxically, those walls with fixed mats covering the whole floor area, or cushioned flooring, seem to have a higher incidence of upper limb injuries. However, when such extensive matting or flooring is provided it tends to be thinner (maximum 10 cm) and designed for absorbing falls close to ground level. The problem is not entirely circumvented by the use of crash mats which are of adequate thickness (up to 50 cm) as ankle fractures in particular still occur. The problem is that the mats are of a fixed size and several must be laid edge to edge to cover the floor area. From incident reports provided it seems that the two most common mechanisms of injury are: (1) a mat is moved by another climber to protect an adjacent area of wall without the knowledge of the climber who initially positioned the mat; and (2) the climber falls and lands with one foot on the mat, the other not meeting the expected resistance but passing between or along side the mat and injuring on impact with the floor below. It would seem that mats providing adequate energy absorption are required—approximately 30 cm thick at least if made from the same materials as currently used, and should cover the entire potential landing area. The seams between mats should also be closed to prevent the passage of a limb.

The more modern walls tend to be higher and have no landing mats on the taller sections (leading walls), but provide fixed ropes which must be used. This allows sustained, difficult sequences of moves to be practised with a fall as the accepted end point until the particular route is mastered. 'Bouldering' walls are often provided

on the same site and are shorter, furnished with mats and do not require the use of ropes. These newer walls have so far proved very safe, with little reported injury on roped sections.

At present, climbing walls seem to be associated with a very low injury rate. Several of the sports centres responding volunteered that the climbing area was the safest in the facility, with a much higher rate of limb fractures occurring on the squash courts or five-a-side football pitches. This rate could perhaps be reduced further with attention to the floor surface and this need not impose on the climbers' freedom to move.

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