The 'S' Quattro – results of treatment in 11 cases of sports injury

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The 'S' Quattro is a dynamic external fixator which has been designed to treat displaced comminuted intra-articular fractures of the phalanges. This type of fracture is commonly the result of a sports injury. We present a follow-up study of 11 cases.

Keywords: Fracture, phalanx, fixator, sport

The management of any displaced comminuted intra-articular fracture has always posed difficult problems. Vidal *et al.*¹ have described the principle of ligamentotaxis and have shown how simple traction can reduce displaced and comminuted fractures by tightening various ligamentous and capsular structures. This principle is now in everyday use in the management of various types of fractures.

A more recent concept is the fixator which applies traction but also allows some movement of the involved joint. Early mobilization is clearly desirable if it can be achieved without jeopardizing the accuracy of the fracture reduction.

The 'S' Quattro is an external fixator designed to treat displaced comminuted intra-articular phalangeal fractures. It works on the principle of ligamentotaxis to reduce and hold the fracture. The system is also elastic and this allows some movement of the affected joint.

Materials and methods

The new fixator is called the 'S' Quattro. This stands for the four Ss in the 'Stockport Serpentine Spring System'. The components are illustrated in Figure 1 and consist of modified K-wires (the 'S' Quattro pins) and serpentine springs.

The pins are introduced percutaneously into normal phalangeal bone either side of the injured joint. Two serpentine springs are then clipped into the pins. A stiffer spring is applied closest to the patient's skin to act as a fulcrum. The second spring is then attached to provide the necessary distraction or compression. Once the springs are in place they are

secured with some plastic padding and further protection is afforded with gauze dressings and a cling bandage. In most cases the fixator is applied with distraction to reduce and hold the fracture on the principles outlined above. Figure 2 illustrates the system in use before, during and some months after treatment.

Figure 1. Diagram to illustrate the position of the 'S' Quattro pins (a). The springs are then applied to distract and thereby reduce the fracture (b)

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Table 1. Patients with comminuted intra-articular fractures sustained during sports

Case	Sex	Age	Sport	Finger involved	Joint	Subluxation
1	M	19	Football	Left middle	PIP	Dorsal
2	M	45	Cricket	Left middle	PIP	Dorsal
3	M	22	Cricket	Left ring	PIP	Dorsal
4	M	30	Football	Right ring	MCP	—
5	M	36	Cricket	Left ring	PIP	Dorsal
6	M	35	Cricket	Right little	PIP	Dorsal
7	M	37	Cricket	Right ring	PIP	Dorsal
8	M	32	Cricket	Left ring	PIP	Dorsal
9	M	47	Cricket	Right ring	PIP	Dorsal
10	M	22	Football	Right middle	PIP	—
11	F	51	Skiing	Left little	PIP	Volar

PIP, proximal interphalangeal joint; MCP, metacarpophalangeal joint

Results

Included in this study are 11 consecutive cases in which the 'S' Quattro was applied to treat a phalangeal fracture sustained during sports.

Figure 2. a, A fracture of the proximal interphalangeal joint with a volar fragment, dorsal subluxation and some central depression of the articular surface. b, The 'S' Quattro has been applied and the fracture is held reduced. c, The end result of treatment is an anatomically restored joint with a good range of movement

Of these 11 cases, three had sustained their injuries playing football, seven had injured themselves playing cricket and one had sustained the fracture in a fall when skiing (see Table 1). The cricketers had all sustained their injuries from a mistimed catch.

The ages of the patients ranged from 19 to 51 years. The skier was the oldest patient and the only female.

In all 11 cases the fracture was displaced, comminuted and intra-articular. In 10 of them the proximal interphalangeal joint was involved and in one the metacarpophalangeal joint. None of the injuries was compound.

In eight patients there was dorsal subluxation of the injured joint and in one there was volar subluxation.

The fixator was usually applied within a week of injury, although nearly 3 weeks had elapsed in two cases. The device was left on the finger for an average of 3½ weeks. Removal of the fixator was followed by intensive hand physiotherapy in all cases.

The results of treatment are illustrated in Table 2. In 10 patients a good range of movement was regained at the injured joint (75–110°). In one case there was marked stiffness (35°), which was subsequently improved with tenolysis (55°).

Eight patients said they were pain free following treatment while the remaining three reported mild discomfort. All 11 of them were satisfied.

Table 2. Results of treatment using the 'S' Quattro

Case	Follow up (months)	Range of movement in the injured joint (degrees)	Pain
1	28	100	None
2	21	35	Mild
3	20	110	None
4	14	90	None
5	12	90	None
6	10	95	None
7	9	75	Mild
8	7	85	None
9	6	90	None
10	6	100	None
11	6	95	Mild

Discussion

The principal indication for using the 'S' Quattro remains the displaced and comminuted intra-articular phalangeal fracture. Many methods have been described to treat these difficult fractures. In general terms the aims of treatment are to regain and maintain the congruity of the joint surfaces. If possible the fixation or splintage should also facilitate early mobilization as stiffness is the main cause of a poor outcome.

Intra-articular fractures in which there is a single fragment of sufficient size can be fixed with a K-wire or an AO screw and this can be achieved open or percutaneously. This method applies to condylar fractures and also selected cases of dorsal or volar fracture dislocation^{2,3}.

K-wire transfixion of the joint has also been a method described for fracture dislocations. This method was first described in the treatment of Bennett's fractures but can be applied to any phalangeal fracture. In addition it can be combined with open reduction and internal fixation^{4,5}. Transfixing the joint enables the dislocation to be reduced and held even in fractures where the fragments are too small to fix. However, this method is less than ideal as it inevitably causes further damage to the affected joint and the presence of the wire excludes early mobilization and encourages stiffness.

The 'S' Quattro has been developed to treat displaced intra-articular phalangeal fractures⁶. It is particularly suitable in cases where the fragments are too small to fix and when there is comminution affecting the joint surfaces. The fixator achieves good reduction of the fracture without interference with the fracture site. It is easy to apply and carries the additional benefit that it permits a degree of movement of the injured joint while maintaining reduction.

Of those patients suitable for treatment with this technique, over half have sustained their injuries during sports. When applied to these difficult cases the 'S' Quattro produces good results and we would advocate its use routinely.

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