Beware of Quickdraws for Self-Belay

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Introduction

A climber climbed up to a bolt 9 metres above the ground, and clipped his harness directly to the bolt with a quickdraw, to take a rest. Directly above the bolt was a piton which he wanted to remove. In order to reach the piton he extended his self-belay with another sling and karabiner (Fig. 1). He then moved up until the slings came tight, and started to remove the piton (Fig. 2). Whilst doing this, he slipped and fell. One of the karabiners broke (Fig. 3) and he fell a further 9 metres to the ground, fortunately without injury.

Fig. 1

Fig. 2

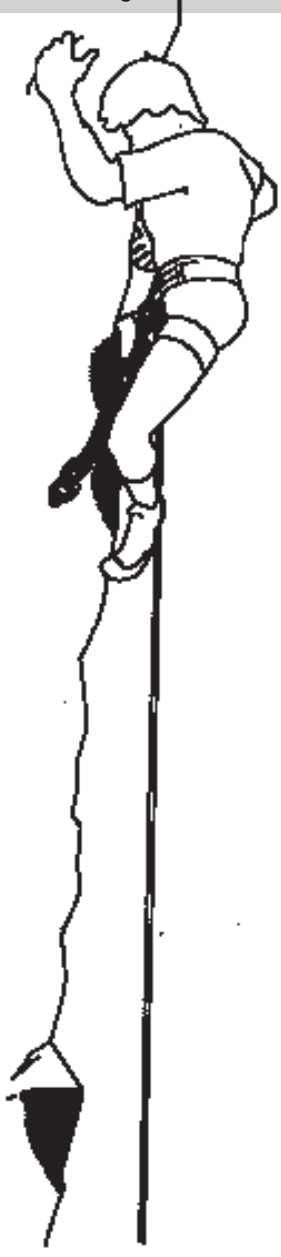

Fig. 3

Analysis of the Events

The climber found some of the bits of the broken karabiner, and sent them for investigation. Initially he had only fallen 1.5 metres, and he did not think that anything should have broken. No damage could be seen on the karabiner gate-latch, and the position and nature of the fracture indicated that the karabiner had fractured whilst the gate was open. On the face of it, this was a classic fall-factor 2 situation, but without any dynamic belay. It is known from rope testing that, if climbing rope had been used for the belay link, this would have generated a force in the range 6 – 12 kN. Since the gate-open strength of the karabiner he was using was only 6 kN, it is not surprising that the karabiner broke. *When using a static belay it is essential always to use screwgate or automatic-locking gate karabiners.* The forces generated are much higher than when using a belay device which allows some slippage.

However, further analysis gave more cause for concern.

Although his belay link was 75 cm long, 25 cm of this was taken up by karabiners, which do not stretch and have no energy absorbing capacity. The only energy-absorbing material in the belay chain was 50 cm of nylon tape slings. So the effective fall-factor was 3, that is to say:

Distance fallen (1.5 m) = 3 x {total length (50 cm) of energy absorbing material}

But nylon tape slings, especially the thick sewn slings used in quickdraws, have much less energy absorbing capacity than climbing rope; they are very strong but stretch very little. So there was concern that, if all the karabiner gates had remained shut, a very high force might have been generated, which might have broken the karabiner in any case.

At this stage Petzl supplied some test information on their 60 cm tape slings. Using an 80 kg mass and a fall-factor 2 drop, the force generated was 18.5 kN on a brand new sling. Repeating the drop a second time on the same sling, the force was greater than 27 kN. Relating this to an effective fall-factor of 3, and taking account of the stiff tape in the quickdraw, it is considered that the force generated would have been in excess of 22 kN. This would have been sufficient to break the karabiner even if the karabiner gate had remained closed.

Conclusions

In a self-belay link:

- keep the number of karabiners to a minimum, preferably not more than one
- always use locking-gate karabiners
- do not use quickdraws, the tape has no energy absorption, and the karabiners do not have locking gates
- preferably do not use nylon slings, use a short length of climbing rope instead
- if using nylon slings, always stay below the belay point to minimise the potential fall-factor in the event of a slip.