Kitesurfing is a new water sport that allows surfing with the power of a power kite. High speeds in boarding across the water as well as several meters high jumps are already possible after a short learning phase of 3–7 days. Kitesurfing combines the use of a stunt kite and sail boarding. The expression of kitesurfing for riding the waves and surfing the wind has become prevalent (Fig. 74.1).

The radical maneuvers and spectacular jumps of 5–10 m height explain the keen interest in this sport. The flying phases often last several seconds. But there have been concerns of possible risks to other water athletes and potential dangers have already led to prohibitions and restrictions.

In 2007, about 10,000 Austrians have carried out this water sport. About 2,000 active kitesurfers have been performing this sport regularly. Athletes are 12 to 75 years with a median range of 20 to 40 years. This sport grows about 30% each year; the rate is similar in Europe and the US. A far less extensive development can be expected of kitesurfing on land – carried out by skis or snowboard.

### 74.1 History

Although the sport of kitesurfing is new, it is not a new invention. People have used this concept for a long time. According to reports, fishermen in Polynesia and Indonesia have used kites for locomotion of their boats already in the 12th century. The kite, which had been fixed and controlled by strings, had been successfully used and presented by the British inventor G. Pocock in 1926 (GB 5420). Kitesurfing in its current sense has begun its development in 1987; the first kitesurfing world cup had been carried out in 1991. The windsurfers Manu Bertin, Laird Hamilton and Robi Naish (from Hawaii) put this sport on the market, which initiated today’s worldwide spread and popularity.

### 74.2 Equipment

Just as in other sailing sports, a high technical expense and development standard are necessary for kitesurfing. The kitesurfing material consists of several parts.

#### 74.2.1 Power kite

Power kites are kites with a wing profile. They do not have a lot in common with the usual toy kites. They are made of special, ultra lightweight, water-repellent and airtight sailcloth. With softer winds, 12–18 m² kites are used; smaller kites of 5–10 m² are reserved for stronger winds (more than six knots). The
most frequently used tube kites are navigated with four lines, while two lines serve the control of the flight direction and two lines are used to change the angle of the kite. A recent development is the use of a fifth line, which has proved successful as protection system and allows immediate “de-powering” (taking pressure off the kite; ➢ Fig. 74.2).

### 74.2.2 The board

The kite boards are 100–140 cm long. They have the shape of wakeboards. Two deck grips allow a firm stand (➢ Fig. 74.3). The classical surfboard with grips and fins and a length of 1.5–2.0 m is mostly used without the deck grips (unstrapped) for kiting in the wave.

### 74.2.3 Further equipment

The kite is controlled with tear-proof, smooth surface texture lines (2 mm Spectra flying lines, ultimate load 2,000 N). The lengths of the lines and thus the action radius of the kite is 20–35 m. This is also the safety distance...
the kiteer needs to lee (downwind side), to both sides and above (Fig. 74.4 a). A bar of a width of 40–70 cm, to which lines are attached, is used as a control device. The arms control the flight direction of the kite. The surfer wears a trapeze harness similar to windsurfing. This relieves arms and frees them for other tasks, e.g. to set the board for start. The trapeze controls the depot function – the changing of the work angle of the kite towards the wind. This combination of different functions turns the control and mastering of the kite into a complex task: wind direction and wind strength influence the positioning of the kite in the air – and only the position of the kite determines the direction of traction and the amount of force the kite can develop (Fig. 74.4 b).

74.3 Overstrain syndromes and injuries

74.3.1 Localization

International Collective, Competition world cup 2002–2005

The author was the sport-medics of a kitesurfing world cup event in 2002 to 2005 (Kristen 2005). The multi-national collective of the top kitesurfers had been surveyed by a standardized questionnaire. Current or recent injuries had been medically examined and treated. 154 data sets had been recorded during the period of 2002 to 2005. About a third of the athletes had been attainable in follow-up, conditioned by the natural fluctuation of the starter fields during the time period of 4 years. The rest had not been actively represented in the world cup anymore, conditioned by their performance, injuries or for other reasons, and had therefore been substituted by young and talented athletes.

The examination of the kitesurfing professionals has led to the following results: 58 injuries had been documented over four years with 50 minor injuries, overstrain, and eight serious injuries and fractures. The most frequently affected body parts were ankle joints, knees, shoulders and thoraxes/ribs. Five fractures (4 × ribs, 1 × ankle joint), 19 capsule/ligament lesions (6 × knee, 5 × ankle joint, 8 × shoulder), 21 overstrain impairments of the spine (11 × cervical syndrome with radicular irritation, 9 × lumbago), two constriction injuries and 4 contusions had been recorded (Tab. 74.1). The distinctive change of the injury pictures during the course of the observed period can be explained by the adjustment of the sport technique and by the changed environmental and wind conditions.

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>Sum</th>
</tr>
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<tr>
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<td>22</td>
<td>37</td>
<td>42</td>
<td>53</td>
<td>154</td>
</tr>
<tr>
<td>injury localization</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>1</td>
<td>6</td>
<td>4</td>
<td>11</td>
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<td>8</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
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<td>2</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
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<td>3</td>
<td>1</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>8</td>
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<tr>
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<td>5</td>
<td>9</td>
<td>19</td>
<td>17</td>
<td>50</td>
</tr>
</tbody>
</table>
The authors have surveyed a national (Austrian) collective of 50 kitesurfers of differently skilled levels ranging from beginners to advanced athletes (Kristen and Kröner 2001, Kristen and Kröner 2002a, 2002b). The data have been recorded retrospectively by a standardized questionnaire over a time period of 2 years (2000–2001). The injured persons have been medically examined in the course of the survey. The following data have been recorded: four fractures (both at the lower costal arch, 8th-10th rib), two contused lacerations (head), two finger injuries (constriction injury), three sprains (ankle joint) and an ankle joint fracture. Injury localizations had been head (17%), thorax and ribs (33%), hand (17%) and ankle joint (33%; ➢ Fig. 74.5).

Fig. 74.5 Spreading of the injury localization with beginners and advanced kitesurfers (according to Kristen and Kröner, 2001).

74.3.2 Risk factors
The insufficiently developed safety-release system has been demonstrated as a dominant risk factor. The kitesurfers had been dragged behind the kite, which had run out of control, without any chance to reduce the traction of the kite. A decisive step in the direction of a better release system is the use of the fifth line, which will allow a distinct de-powering. Safety mechanisms definitely must be exercised because otherwise they will not be used in cases of emergency. The dominant personal risk factor is the overestimating of one’s own skills and the disregard of critical wind and weather situations.

German collective 2000–2001
Prospective studies (Petersen et al. 2002, Nickel et al. 2004, Petersen et al. 2005) could provide evidence of a general injury risk of four to seven injuries in 1,000 hours of sport performance in a mixed collective. The survey has considered data of the German-speaking world from 2000 to 2001. The kite that could not be separated from the trapeze harness in critical situations had been referred to as cause of 56% of all injuries.

74.3.3 Injury mechanisms
Abrasions, bruises and constrictions: the typical beginners’ injuries, which develop by falls on the beach, near the beach or against firm obstacles near the water. Unpracticed handling and entangling fingers in the thin and extremely tensile lines causes constriction injuries. Bounces of several seconds, which are possible due to the upwards traction of the kite, lead to ankle joint or knee injuries (➢ Fig. 74.6). These joints are also affected by hard landings (ligament lesions, fractures). The optimal landing should be a soft touching and floating to the ground – this requires a lot of skill and
feeling in the control of the kite during the flight phase.

A sport-specific overstrain impairment is the stress fracture of the ribs, primarily of the 7th and 9th rib. Cause of those rib fractures is the pressure of the trapeze harness to the waist, combined with high traction and rotation forces.

### 74.4 Sport-specific strains and demands

#### General preconditions

Not the strength but the sport technique is the decisive criterion of this sport. A high measure of balance is necessary for the control of the board. The largest effort is the control of the kite in wind. Good knowledge of the weather and a feeling for the force of the wind are key. Indispensable basic physical conditions are the abilities to perform pull-ups and adequate swimming skills.

#### Spine

The lumbar spine is subject to extreme rotation and flexion strain, because the traction of the kite is transmitted via arms and trapeze to the legs. Kitesurfing is therefore a good exercise for the trunk muscles. The axial strain of the lumbar spine is reduced obliquely upwards. The cervical spine is highly strained, especially beginners control the position of the kite in the air with the eyes in a “back-tilted head position”. Whiplash injuries of the cervical spine cannot be avoided at spinning falls with high speeds. The over the bar fixed shoulder girdle has an intensifying effect.

#### Shoulder joints

Subluxations and dislocations can appear even in shoulder joints with well stabilized muscles because of the high and often sudden traction strain to the arms – a critical situation in the water without outside help. The recent development in competitive kitesurfing with “handle pass” maneuvers (the bar will be handed from one hand to the other during a jump – a trick from show waterskiing) has led to a clearly increased incidence of shoulder injuries of top athletes. A strong shoulder girdle and good shoulder-stabilizing muscles are the precondition of kitesurfing.

### Danger to others

The power kite as well as the tensed lines can become not only a risk for the athlete himself, but also a risk for other water athletes and bathers, if they are used by an unpracticed or irresponsible athlete. The German Federation of Windsurfing and Watersport Schools has set up rules for this new sport. The adherence to safety distances must be urged especially for the prevention of a danger to uninvolved persons. A crash is pre-programmed in areas with dense traffic, because the safety radius in kitesurfing with a line length of 20–30 m amounts to 100 m to lee (downwind side) and 50 m to the side.

### Summary

Kitesurfing is a sport that includes a third dimension in watersports. It conveys the feeling of floating over the water, only driven by the force of the wind, due to the upward traction of the kite. The large requirement of space of kitesurfers reduces the territories, especially in Central Europe, to only few spots. The long lines and the kite itself present a risk for bathers and other water athletes, if the flight of the kite is not mastered or if the athlete does not act responsibly. New safety functions (e.g. safe and fast de-powering systems) have been developed. 80–90% of all rescue efforts in water athletes (referring to all watersports) are necessary, because the own abilities and fitness had been overestimated (Exadaktylos et al. 2000). The following precautions are recommendable for kitesurfers:

- attendance of a kitesurfing class with according safety exercises
- mastering the kite; estimating the risk zone as well as maintaining the safety distance to the side and to lee
- knowledge of the territory; this includes the maintaining of safety distances to surrounding areas in addition to the knowledge of wind and streams.

An important step has been taken by the further development of the safety release system of kite and kiteboard. But further work and custom-oriented test are needed.
References


