1. A skier lands on one leg with the ski flat on the slope as given in the sketch below (a); the landing ski is pointing straight ahead. Calculate the force $F_{ACL}$ produced by the quadriceps if exerting $F_q = 5000$ N (b). Does the skier have a chance to take off load from the ACL without changing body configuration? If yes, how? How and why would the loading situation for the ACL change if the landing ski would be pointing inwards (medially) or outwards (laterally)? How can ACL injuries of such kind be prevented? List and briefly explain three different possibilities.

a) 

b)
Assumption: the patella slides in the femoral groove like a pulley system. Then, the whole force $F_q$ will be transferred to the patella tendon.

The sketch (b) shows that the angle between $F_{ACL}$ and $F_q$ is $60^\circ$ ($\gamma=60^\circ$).

$$\cos \gamma = \frac{F_{ACL}}{F_q}$$

$$\Leftrightarrow F_q \cdot \cos \gamma = F_{ACL} = 5000 \text{ N} \cdot \cos(60^\circ) = 2500 \text{ N}$$

The skis could activate the hamstrings ($F_h$) which would apply a force opposing the downward pull from the quads.
Since the ACL inserts at the inner side of the tibia and laterally on the femur an internal rotation of the tibia would impose greater strain to the ACL.

So: Ski inwards greater strain! 
Ski outward less strain! 

Omitting this landing position would be best but that doesn't count!

• According to above: strengthen your hamstrings
• Use ski bindings which allow for backward release (upward for the front part of the binding)

• Use shoes with more flexible shafts. (bad for maintaining forward lean)

• Shocks Skis to reduce the lever effect of the ski (use carving skis)

It needs to be considered that as soon as the leg turns out the ski would also run away from the skier possibly inducing valgus loading at the knee which would then strain the ACL even more.

Other possibilities ...