Common injuries in cycling: Prevention, diagnosis and management

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Introduction

The health benefits of participating in regular physical activity are well established, and prescribing exercise to prevent and treat chronic disease is becoming more frequent. In addition, medical insurers and medical schemes use various incentive schemes to encourage their members to engage in regular physical activity. Recreational cycling, as one of the options for regular exercise, is therefore also increasing in popularity. In South Africa, mass participation in recreational and competitive cycling events is growing. It is therefore not surprising that patients presenting with injuries related to cycling have also increased. As a result, the family practitioner is likely to be consulted more frequently to deal with these injuries. The purpose of this article is to briefly discuss a clinical approach to the more common acute and chronic injuries that cyclists may experience.

Acute injuries suffered by cyclists

Cyclists usually suffer acute injuries during accidents. The causes of accidents vary, from a collision with a motor vehicle (> 50% of cases) , road surface damage and obstacles, to mechanical problems with the bicycle (12-24%). Risk factors for more serious, acute traumatic injuries in cyclists are collision with a motor vehicle (4.6 times higher than other mechanisms of injury), increased cycling speed > 28km/h, and age (younger age – < 6 years, and older age – > 39 years) . Acute cycling injuries can cause damage to any anatomical area, including the head, neck, face, eye, upper and lower limbs (most common), spine, abdomen and skin (see Figure 1).

The various types of acute cycling injuries are depicted in Figure 2. The majority of these injuries are superficial abrasions, lacerations and contusions. More severe injuries, such as fractures, dislocations, head injuries and injuries to internal organs, account for 5-25% of all acute cycling injuries.

"Off-road" cycling has also been increasing in popularity. It has been documented that the injury risk and the overall pattern of the anatomical location of injuries are similar in conventional cyclists and "off-road" cyclists, but that the severity of injuries in "off-road" cyclists is lower. This reduction in severity has been attributed to a reduced average cycling speed, and the observation that "off-road" cyclists use cycling helmets more readily.

The more serious acute injuries in cyclists that can result in fatalities are related to trauma to the head and neck and deserve further discussion.

Figure 1: Anatomical site of acute injuries in cyclists (expressed as a percentage of all the acutely injured cyclists – some cyclists were injured in more than one area)[6]

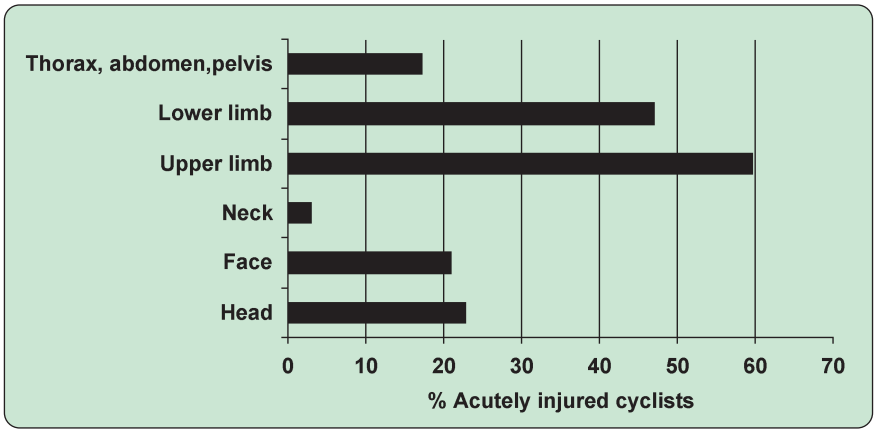
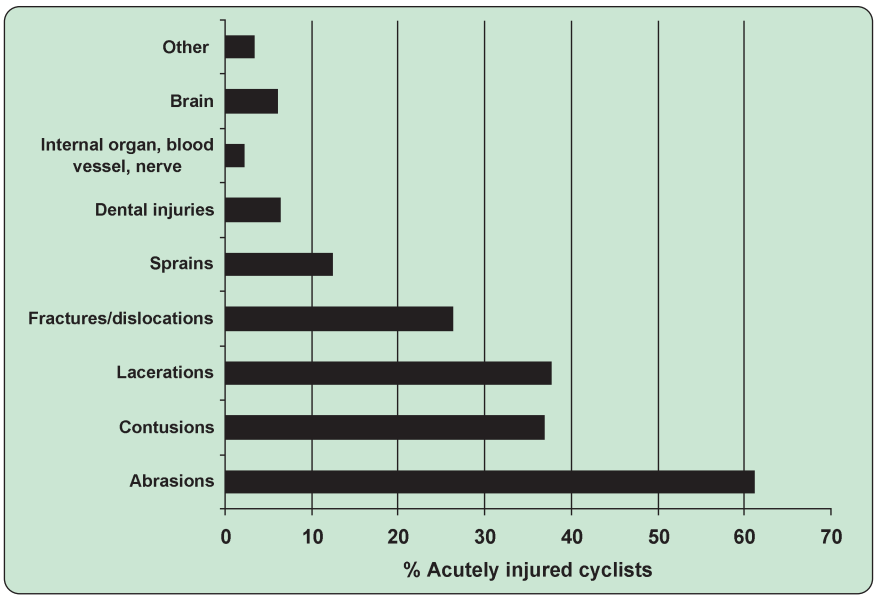


Figure 2: The type of acute injuries in cyclists (expressed as a percentage of all the acutely injured cyclists – some cyclists were injured in more than one area)[6]



Acute head, neck and facial injuries suffered by cyclists

Acute head and neck injuries are by far the most serious injuries suffered by cyclists and account for most of the fatalities caused by cycling. The scientific evidence that bicycle helmets protect the head, brain and face from more serious injuries is now well established. It has been shown that the use of cycling helmets can reduce the risk of head injury by 85%, brain injury by 88%, and severe brain injury by more than 75%. In a recent study, the type of cycling helmet and the subsequent reduction in head injury risk were investigated. It was shown that the hard-shell helmet type reduces the risk of head injury by 64%, compared with a 17% reduction in risk when a foam helmet is used.

Practical recommendations to reduce the risk of acute injuries suffered by cyclists

Health professionals can make the following practical recommendations to reduce the risk of acute injuries in cyclists:

- Encourage the use of designated cycling areas (lanes) to avoid sharing roads with motor vehicles
- Cycle on appropriate road surfaces free from damage or obstacles

- Younger and older cyclists are at higher risk of injury
- Encourage the use of cycling helmets (particularly the hard-shell type)
- Educate younger cyclists on the need to wear cycling helmets
- Encourage the use of front and rear lights or reflectors on bicycles
- Encourage the wearing of high-visibility clothing
- Discourage the use of alcohol before and during cycling

Chronic injuries suffered by cyclists

Chronic injuries, also known as overuse injuries, are also frequent in cyclists. They are generally less severe, but can be the source of great frustration to the cyclist and the medical practitioner who is consulted to solve the clinical problem. In one survey among 294 male and 224 female recreational cyclists, 85% of cyclists reported one or more overuse injury, with 36% of these injuries being reported as severe enough to warrant medical attention. The most common anatomical sites for overuse injuries are the neck (48.8%), knee (41.7%), groin/buttock area (36.1%), hands (31.1%), and lower back (30.3%).

In this review article, common injuries occurring in these anatomical sites will be discussed. A detailed review of each injury is beyond the scope of this article, but principles of diagnosis and management will be highlighted.

The principles of management of these injuries rely on firstly establishing a precise anatomical and pathological diagnosis of the injury and, secondly, identifying the underlying intrinsic (related to the cyclist) and extrinsic (related to the bicycle and the environment) risk factors associated with the injury. Treatment generally follows two phases. The first phase involves the treatment of the symptoms, and the second phase the countering of the underlying causes.

Chronic neck pain suffered by cyclists

Neck pain in cyclists is thought to occur as a result of muscle spasm (particularly the levator scapulae and the trapezius muscles), perhaps in response to constant hyperextension of the neck during cycling. Predisposing factors would therefore include poorly conditioned upper back musculature, "dropped" handlebars, raised saddle, and a "heavy" cycling helmet to which the rider is not accustomed.

The management and prevention of neck pain in cyclists will include treatment of the muscle spasm in the first phase. The treatment of the

underlying cause of the injury may include altering the cycle/rider mechanics (shortened handlebars, raised handlebars, reduced saddle height), conditioning the upper back muscles, and perhaps reducing the weight of the cycling helmet. Persistent pain should be investigated further and cervical radiculopathy and degenerative arthritis should be excluded, particularly in older cyclists.

Chronic knee pain suffered by cyclists

Chronic knee pain is a very common injury in cyclists. Although there may be many causes for chronic knee pain, only anterior and lateral knee pain will be discussed in this article, as they are reported most frequently.

Chronic anterior knee pain suffered by cyclists

The most common cause for chronic anterior knee pain in cyclists is patellofemoral pain syndrome (PFP). This is a condition where repetitive flexion/extension of the knee results in peri-patellar pain. During cycling, the force generated by quadriceps muscle contraction during the downstroke (knee extension) is translated to the patellofemoral joint. This patellofemoral joint reaction force is thought to injure the peri-patellar structures, resulting in injury.

Predisposing factors to PFP in cyclists include training errors (rapid increases in training volume, incorrect use of bicycle gearing, increased hill training), incorrect pedal/foot interface (type of cycling shoes and cleats used), incorrect bicycle set-up (incorrect frame size, saddle height too high or low, incorrect saddle position – usually too far forward), muscle imbalances (quadriceps and jip stabiliser muscles), and anatomical abnormalities in the cyclist (small mobile patella, hypoplasia of the lateral femoral condyle, patella alta).

In recent years, biomechanical studies using two-dimensional video analysis conducted at the Sports Medicine Unit of the University of Cape have shown that cyclists with PFP exhibit an abnormal nonlinear pattern of knee movement during the downstroke of cycling. Once this abnormal pattern is corrected (by using custom-made orthoses, altering the cleats, or by altering saddle height), PFP can be treated effectively.

The principles of management of PFP in cyclists are to treat the pain, followed by altering training and correcting other predisposing factors. The bicycle set-up, as well as biomechanical analysis of the downstroke, may be required to reduce the loads on the patellofemoral joint.

Iliotibial band friction syndrome

The most common cause of chronic lateral knee pain in cyclists is iliotibial band (ITB) friction syndrome. This injury is thought to occur as a result of repetitive mechanical friction between the iliotibial band and the lateral femoral condyle. The diagnosis is made by careful clinical examination. Pain can be reproduced by repetitive knee flexion and extension while applying pressure over the lateral femoral condyle. Classically, pain is maximal at 30° knee flexion – the angle at which the ITB crosses over the femoral condyle (known as the ITB impingement angle).

Specific predisposing factors for this injury in cyclists have not been well studied. In a recently published study, researchers showed that the minimum knee flexion angle during cycling (at the bottom of the downstroke) is close to the ITB impingement angle. Therefore, apart from correcting training errors and conditioning the hip stabiliser muscles, the adjustment of saddle height is probably the most effective management of ITB friction syndrome in cyclists.

Chronic groin/buttock pain suffered by cyclists

Chronic buttock and groin pain is a common complaint of cyclists. This pain is caused by the pressure of the saddle during prolonged sitting and can result in injury to several anatomical areas. These injuries can include saddle (pressure) sores, perineal folliculitis and furuncles, callosities, subcutaneous fibrosis, and subcutaneous perineal cystic nodules. Male cyclists can develop pudendal neuropathy, resulting in numbness or tingling in the scrotum or the penis. Prolonged compression of the pudendal nerve, usually following repeated and multi-day rides and resulting in transient impotence in male cyclists, has been documented. Traumatic urethritis and torsion of the testis have also been described. Female cyclists may experience a variety of vulval trauma, including superficial abrasions, lacerations, contusions and haematomas.

The management of these injuries involves the treatment of the acute phase by means of antiseptic creams or powders, as well as corticosteroid creams or antibiotics if required. However, the most important advice for cyclists is to prevent these injuries by observing the following principles:

- Use a modern, anatomically designed saddle (different for male and female cyclists)
- Use padded cycling shorts that are cleaned daily (multiple day-rides)
- Consider shaving the perineal area

to avoid traction on hair follicles
- Adjust the seat position (height, anteroposterior tilt) to distribute the pressure evenly while seated

Chronic hand pain suffered by cyclists

Cyclists participating in multi-day events can present with chronic numbness and tingling, with associated weakness of the muscles of the hand. In a recent study among cyclists participating in a 600 km multistage event, 92% of the cyclists experienced motor or sensory symptoms of the hand. The most common injury is ulnar nerve compression, causing symptoms in the ulnar nerve distribution (ring and little finger). The median nerve is involved less commonly. The cause of this injury is related to constant pressure and vibration, with the wrist in prolonged wrist hyperextension and abduction. Treatment involves refraining from cycling until the symptoms resolve. Prevention entails wearing cycling gloves, adjusting the handlebar position, applying padding to the handlebars, frequently altering hand position during cycling, and reducing body weight on to the handlebars.

Chronic lower back pain suffered by cyclists

Chronic lower back pain in cyclists is usually the result of the prolonged flexed position. Causes can be related to intervertebral disc compression, traction on the facet joint capsules, and traction resulting in muscle strain or ligamentous sprain. Recently, it has been suggested that a variant of chronic compartment syndrome may develop in the back extensor muscle groups in some cyclists. All cyclists with lower back pain must be evaluated for other causes by means of an appropriate clinical examination and special investigations, as required.

The prevention of lower back pain is related mainly to proper bicycle set-up. Adjusting the saddle angle appears to be particularly effective in reducing back pain during cycling. Adjustments to saddle height, handlebar height, handlebar position and handlebar length may also be required. Attention should also be paid to lower abdominal and core muscle and flexibility.

Other injuries suffered by cyclists

Other injuries that cyclists can suffer include foot parasthesias (usually from toe clips and shoes that are too tight), metatarsalgia, and Achilles tendon injuries. The effects of sun damage must also be considered.

Summary and conclusion

Cycling is a healthy recreational activity, although it can result in acute and chronic injuries. Acute injuries are usually the result of accidents, and preventative measures can be taken to avoid them. The most important measure for preventing serious acute injury is to wear a hard-shell cycling helmet. Chronic overuse injuries are usually the result of training errors and a poor bicycle-cyclist "fit". The key components of preventing chronic injuries are to ensure that the cyclist and the bicycle are appropriately matched, and that training follows well-established scientific principles.

See CPD Questionnaire, page 30

References

1. See LC, Lo SK. Cycling injuries among junior high school children in Taiwan. *J Formos Med Assoc* 1997;96:641-8.
2. Rivara FP, Thompson DC, Thompson RS. Epidemiology of bicycle injuries and risk factors for serious injury. *Inj Prev* 1997;3:110-4.
3. Mellion MB. Common cycling injuries. Management and prevention. *Sports Med* 1991;11:52-70.
4. Stone M, Broughton J. Getting off your bike: cycling accidents in Great Britain in 1990-1999. *Accid Anal Prev* 2003;35:549-56.
5. Powell EC, Tanz RR. Cycling injuries treated in emergency departments: need for bicycle helmets among preschoolers. *Arch Pediatr Adolesc Med* 2000;154:1096-100.
6. Rivara FP, Thompson DC, Thompson RS, Rebolledo V. Injuries involving off-road cycling. *J Fam Pract* 1997;44:481-5.
7. Pfeiffer RP, Kronisch RL. Off-road cycling injuries. An overview. *Sports Med* 1995;19:311-25.
8. Chow TK, Bracker MD, Patrick K. Acute injuries from mountain biking. *West J Med* 1993;159:145-8.
9. Thompson DC, Patterson MQ. Cycle helmets and the prevention of injuries. Recommendations for competitive sport. *Sports Med* 1998;25:213-9.
10. Robinson DL. Head injuries and bicycle helmet laws. *Accid Anal Prev* 1996;28:463-75.
11. Hansen KS, Engesaeter LB, Viste A. Protective effect of different types of bicycle helmets. *Traffic Inj Prev* 2003;4:285-90.
12. McGuire L, Smith N. Cycling safety: injury prevention in Oxford cyclists. *Inj Prev* 2000;6:285-7.
13. Rosenkranz KM, Sheridan RL. Trauma to adult bicyclists: a growing problem in the urban environment. *Injury* 2003;34:825-9.
14. Bishai D, Qureshi A, Cantu N, Parks C. Contracting with children and helmet distribution in the emergency department to improve bicycle helmet use. *Acad Emerg Med* 2003;10:1371-7.
15. Frank E, Frankel P, Mullins RJ, Taylor N. Injuries resulting from bicycle collisions. *Acad Emerg Med* 1995;2:200-3.
16. Wilber CA, Holland GJ, Madison RE, Loy SF. An epidemiological analysis of overuse injuries among recreational cyclists. *Int J Sports Med* 1995;16:201-6.
17. Holmes JC, Pruitt AL, Whalen NJ. Lower extremity overuse in bicycling. *Clin Sports Med* 1994;13:187-205.
18. Gregor RJ, Wheeler JB. Biomechanical factors associated with shoe/pedal interfaces. Implications for injury. *Sports Med* 1994;17:117-31.
19. Van Zyl E, Schwellnus MP, Noakes TD. A review of the etiology, biomechanics, diagnosis and management of patellofemoral pain in cyclists. *ISMJ* 2001;2.
20. Bailey MP, Maillardet FJ, Messenger N. Kinematics of cycling in relation to anterior knee pain and patellar tendinitis. *J Sports Sci* 2003;21:649-57.
21. Farrell KC, Reisinger KD, Tillman MD. Force and repetition in cycling: possible implications for iliotibial band friction syndrome. *Knee* 2003;10:103-9.
22. Andersen KV, Bovim G. Impotence and nerve entrapment in long distance amateur cyclists. *Acta Neurol Scand* 1997;95:233-40.
23. Spears IR, Cummins NK, Brenchley Z, Donohue C, Turnbull C, Burton S, *et al.* The effect of saddle design on stresses in the perineum during cycling. *Med Sci Sports Exerc* 2003;35:1620-5.
24. Keytel LR, Noakes TD. Effects of a novel bicycle saddle on symptoms and comfort in cyclists. *S Afr Med J* 2002;92:295-8.
25. Patterson JM, Jaggars MM, Boyer MI. Ulnar and median nerve palsy in long-distance cyclists. A prospective study. *Am J Sports Med* 2003;31:585-9.
26. Sanner WH, O'Halloran WD. The biomechanics, etiology, and treatment of cycling injuries. *J Am Podiatr Med Assoc* 2000;90:354-76.
27. Salai M, Brosh T, Blankstein A, Oran A, Chechik A. Effect of changing the saddle angle on the incidence of low back pain in recreational bicyclists. *Br J Sports Med* 1999;33:398-400.
28. Helzer-Julin M. Sun, heat, and cold injuries in cyclists. *Clin Sports Med* 1994;13:219-34.