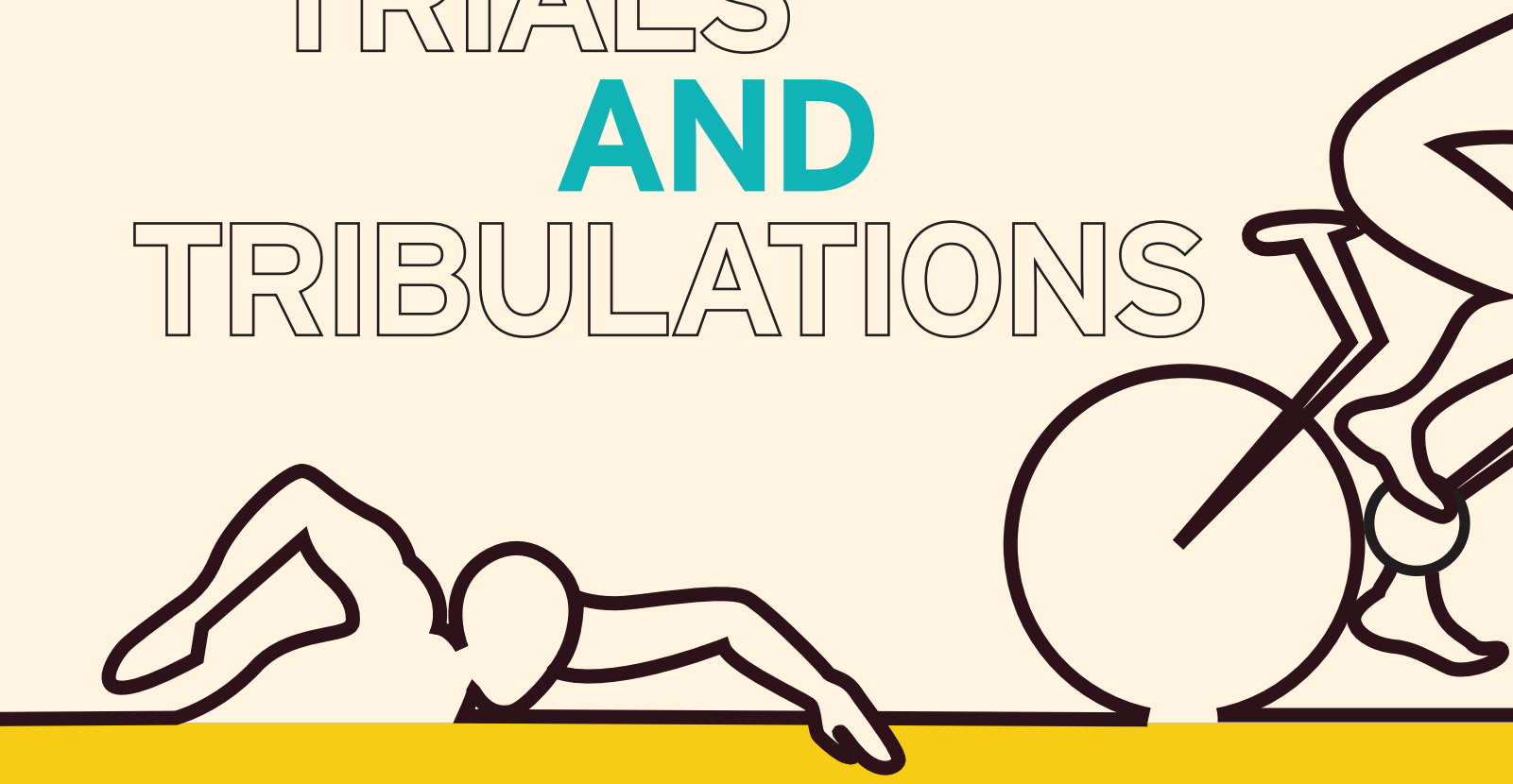
TRIALS AND TRIBULATIONS



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DISCUSS THE TREATMENT AND REHABILITATION OF INJURIES ASSOCIATED WITH TRIATHLON

At the London 2012 Olympics, the Brownlee brothers put triathlon at the forefront of British sport when Alistair won the gold medal and Jonathan the bronze. In 2016, Jonathan went one place better, finishing second behind his brother. Although the siblings were involved in triathlon for many years before 2012, their success has elevated the sport in the UK and seen significant increases in participation (British Triathlon, 2015).

The sport is characterised by three sequential and continuous events: swimming, cycling and running. The standard Olympic distance is 1500m in the pool, 40km on the bike and 10km on the road. The physiological and physical demand of the sport is quantified not only by the individual characteristics of the three events but also by the cumulative effect of all three taking place uninterrupted, other than by the transition phases.

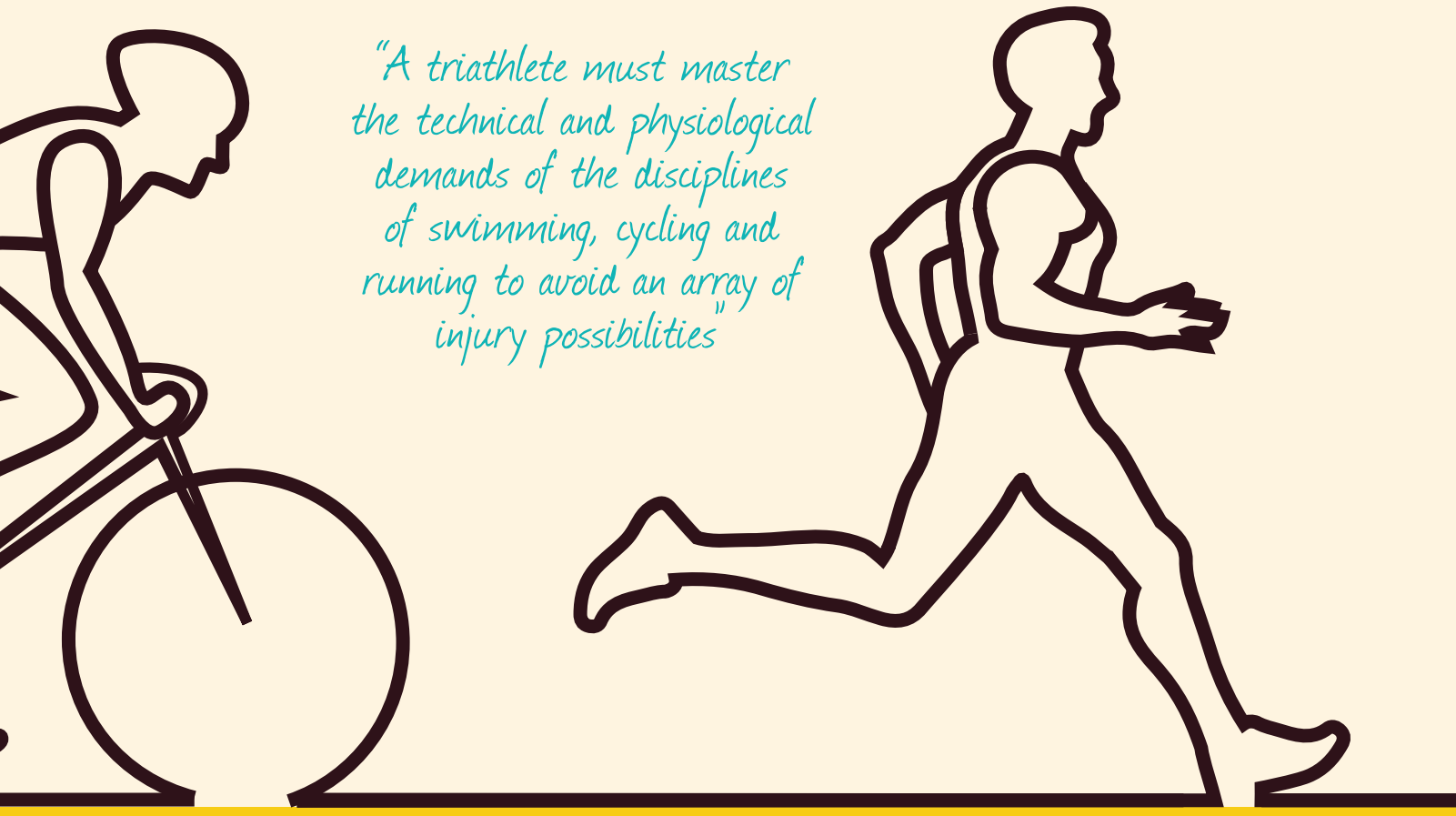
Coupled with the technical demands of each event, the risk of injury is greatly increased in both training and competition environments (Zwingenberger et al, 2014). Triathletes are vulnerable to the full spectrum of injuries that could be sustained from swimming, cycling and running.

In addition, the cumulative effect of minor injury, addressed through the body's compensation mechanisms, can further heighten the risk of serious injury. Most triathletes suffer from overuse or overtraining injuries and although acute injury has been reported, during competition the associated incidence of this is relatively low (Andersen et al, 2013).

> "Tightness in the quadriceps and hip flexors reduces the range of motion in the hip, increasing the energy cost of running"

A triathlete is naturally a cross-trainer and less likely to develop muscle imbalances than a single-discipline participant such as a distance runner. None of the Olympic distance triathlon disciplines are as long in duration or as high in intensity as the individual disciplines of running, swimming or cycling. However, a triathlete must master the technical and physiological demands of each discipline to avoid an array of injury possibilities. If the athletes engage with the longer Ironman events (3.8km swimming, 180km cycling and 42.2km running), physical and physiological demands are further amplified and increase the risk of injury.

Most injuries occur during the running event (50%), followed by cycling (43%) and swimming (7%) (Zwingenberger et al, 2014). The lower extremities are injured more frequently – ankle (20.6%), knee (18.3%) and thigh (15%) – than the upper extremities – lumbar region (12.6%) and shoulder (8.3%) (Galera et al, 2012). These figures are not surprising, given that running is a higher-impact sport and this impact is coupled with the potential onset of fatigue as the third and final event in the triathlon.



"A triathlete must master the technical and physiological demands of the disciplines of swimming, cycling and running to avoid an array of injury possibilities"

WHY DO TRIATHLETES GET INJURED?

The ways in which a triathlete can get injured include the following:

- Doing too much too soon in training
- Not allowing for proper recovery from competition and/or training
- Muscle strength and flexibility imbalances
- Environmental conditions: for example, water temperature being too low
- Wearing incorrect or inappropriate footwear
- Riding a poorly fitted bike: for example, wrong seat height and pedal alignment.

These factors tend to exaggerate the injury risk potential when coupled with the demands of the event and yet are easily rectified, minimised or preventable prior to participation.

For example, the correct footwear is essential to reduce the repetitive impact during running; an appropriate wetsuit thickness can minimise temperature differentials between the body and water; a correctly fitted seat height can reduce lower back pain; and suitably aligned shoe or pedal interfaces can significantly reduce hip and knee pain.

PICTURES: ISTOCK; SHUTTERSTOCK

TABLE 1: EXAMPLE OF MUSCLE IMBALANCE OUTCOMES

Muscular imbalance	Resultant injury
Weak and inhibited gluteal muscles	Iliotibial (IT) band injury, anterior knee pain, anterior cruciate ligament injuries
Tight anterior shoulder muscles	Swimmer's shoulder (tendon impingement injury)
Tight hamstrings	Lower back injuries, breaststroker's knee

MUSCLE STRENGTHENING AND FLEXIBILITY

Muscle and tendon stretching and muscle strengthening will help reduce muscular imbalances for the triathlete. But if left untreated or unattended, imbalances and weaknesses will escalate and place undue stress on particular areas of the body, which may result in injury.

Many imbalances cause a weakness on one side of a joint, which can lead to injury. If that weak muscle is fighting a tight muscle on the opposite side, fatigue will set in more quickly and lead to poor biomechanics, specifically joint alignment affecting the dissipation of impact forces, which can compromise the integrity of a joint and increase injury risk. Table 1 above illustrates some key resultant injuries.

STRENGTHENING EXERCISES AND GLUTE INHIBITION

Many athletes are often told that their gluteal muscles (glutes) are weak or 'switched off'. This can have a negative influence on performance as research has indicated a relationship between diminished glute function and the onset of athletic injury (Distefano et al, 2009).

There are two main types of problem that occur around the hips and pelvis, affecting glute function and thus creating muscular imbalances and the potential for injury: glute inhibition and glute weakness.

Table 2 overleaf highlights the common causes associated with glute inhibition and weakness, and how specific exercises can help prevent and reduce these problems.

"The thickness, fit and buoyancy of the wetsuit is important. Keeping the body warm is necessary to prevent the onset of cramp and maintain full body range of motion"

STRETCHING EXERCISES

Triathletes who have greater flexibility perform more effectively and efficiently.

During swimming, a flexible shoulder allows the hand to recover close to the body, thus permitting a full range of motion and a longer stroke. An ankle capable of completely flattening out reduces drag when swimming, while quadriceps and hip flexors that are more flexible aid running by allowing the recovery leg to swing through a wider arc. Tightness in the quadriceps and hip flexors reduces the range of motion in the hip, increasing the energy cost of running.

During cycling, tight hamstrings limit performance by restraining the leg during the downstroke. Some triathletes compensate by lowering their saddle, which tends to reduce force generation and thus efficiency and performance. By preventing the leg from straightening, it reduces the maximum transmission of the force produced through hip and knee extension. Hamstrings are also a common cause of a tight lower back, and can restrict performance and increase injury risk in every triathlon discipline.

Table 3, right, provides examples of basic stretches targeting specific muscle groups.

TABLE 2: GLUTE INHIBITION AND WEAKNESS – CAUSES AND EXERCISES

	Glute inhibition	Glute weakness
Causes	Daily lifestyle factors such as excessive sitting can result in the hip flexors becoming tight and overactive; this will put the pelvis into an anteriorly tilted position. The hip flexors (iliopsoas) will become overactive, which can cause reciprocal inhibition, where the glutes are inhibited by the hip flexors.	Very common in triathletes who spend a lot of time on the bike, cycling is a 'quadricep (quad) dominant' exercise. If left un-addressed in terms of adding exercises to target the glutes, this kind of strength imbalance can cause injury problems over time, as the body learns not to use the glutes and tries to favour the stronger quads.
Exercises	To correct an anterior tilted pelvis you need to: **1.** Stretch and mobilise the lumbar spine, thoracic spine and anterior hip **2.** Strengthen anterior core **3.** Strengthen glutes and hamstrings. Examples of exercise that can be used: ● Glute bridge (feet on floor and box elevation) ● Planks.	Examples of exercise that can be used to strengthen the glutes: ● Isometric contractions for the weaker glute ● Side-lying abductions with the weaker leg ● Side-lying clams with the weaker leg ● Quadruped hip extensions with the weaker leg ● Single leg glute bridges with the weaker leg.

INJURY PREVENTION

As well as the strengthening and flexibility exercises, triathletes should consider the equipment they use, specifically anything affecting technical performance.

Correctly fitting footwear for both running and cycling is imperative from both a safety and performance perspective. Having the bike professionally fitted in terms of frame size, weight, seat height, crank length and shoe-pedal interface are useful aspects to consider prior to training or competing. However, after making adjustments from a proper bike fit, minor aches and pains may develop, and it is important that the therapist and athlete realise this common scenario. It is therefore useful to have a basic understanding of bike fitting and how anatomical factors and training errors contribute to injuries.

The following are examples of specific pains caused by those factors.

Pain in the anterior aspect of the knee

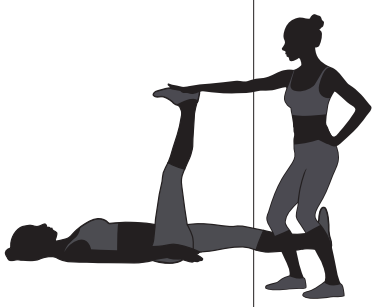
This could be due to powerful 'cycling quads', which might deliver too much shear force across the joint – check saddle height, saddle fore and aft, and/or crank length.

If the athlete has no knee pain, the correct saddle height should allow for 25 to 30 degrees of flexion of the extended leg when the pedal is at the bottom, dead centre.

If the triathlete has this knee pain, they would require greater than 30 degrees of flexion, and therefore the seat should be lowered.

If the saddle is too low, it could increase the shearing force across the patella, which could result in a tendinopathy and, as such, the seat should be adjusted accordingly.

TABLE 3: TARGETED MUSCLE GROUP STRETCHES

Stretch	Targeted muscle group	Explanation
Deep lunge 	Glutes (front leg)	• Step your right leg far forward into the lunge position • Lower hips as much as you can • Hold for 30 seconds and then repeat on the opposite side.
Pigeon stretch 	Glute muscles	• Place your front lower leg crossways onto a mat • Stretch your other leg back as far behind you as you can • Lean forward to increase the stretch in your glute muscle • Hold this for 30 seconds and then swap sides.
Kneeling quad stretch 	Quad muscles	• Kneel on your right knee and put left foot in front of you so your left knee is at 90 degrees • Grab your right foot behind you • Pull your right foot up to your buttocks • Hold for up to 30 seconds and then switch sides.
Proprioceptive neuromuscular facilitation (PNF) 	Hamstring muscles	• Lie on your back and get a partner to lift one leg up gently, as far as it will go • Contract – push against resistance with a straight leg at 25% effort. The resistance must be great enough so that the leg cannot move • Hold for 10 seconds then relax • Use hip flexor muscles (agonists) to pull the leg up as high as you can, keeping it straight and holding this for up to 10 seconds • Repeat process until no more gains are possible (contract).

Pain in the posterior aspect of the knee

This is less common than pain in the anterior aspect, and is usually due to overextending the knee. To correct, the saddle could be lowered slightly or brought forward on the frame.

Pain on the medial side of the knee

If the athlete has pain on the inside of their knee, observe their foot position on the pedal and check the cleats. Improper cleat placement, which can affect the Q angle, is normally the problem. Too much float in the pedals can also cause medial knee pain.

Pain on the lateral side of the knee

This is normally caused by IT band syndrome and can be linked to misaligned cleats that cause the foot to be excessively 'toed in'. Adjust the shoe alignment on the pedal.

All these injuries are usually associated with the technical set-up of the bike and the choice of footwear.

In addition to the land-based disciplines of triathlon, the swimming component of the sport can also result in injury. Most competitive triathlon events start with an open-water swim, so the thickness, fit and buoyancy of the wetsuit is important. Keeping the body warm is necessary to prevent the onset of cramp and maintain full body range of motion, particularly in the shoulder. The maximum thickness of a wetsuit for competitive triathlon events is 5mm and triathlon-specific wetsuits combine warmth, flexibility and buoyancy to aid the swim. The wetsuit should fit snugly and allow full range of motion around the shoulders. The wetsuit tends to get slightly thicker around the middle of the body and the thighs, which has the dual purpose of keeping the essential organs of the body warm – thus maintaining blood flow to the large working muscle groups – and helping with buoyancy. If the wetsuit does not fit correctly and inhibits full shoulder range of motion, the onset of injury is likely, as noted in Table 1.

CONCLUSION

The triathlon is one of the most physiologically and technically demanding Olympic events. Not only do the individual disciplines have their own specific injury risk factors but when performed sequentially, in a competition setting, they provide a potentially cumulative effect that can significantly increase the risk of injury onset.

Technical preventative measures such as bike fitting, footwear and wetsuit choice can help reduce injury; however, muscle strength, balance and flexibility are imperative to ensure the likelihood of injury is minimised.

Our knowledge of the causes of sports injuries is fundamental to our ability to help athletes recover. But triathlon is a unique sport that tests our knowledge not only of injury and rehabilitation but also of the technical demands and cumulative effect that participation can have on the onset of injury in this sport. IT

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REFERENCES

For references and further reading, visit **fht.org.uk/IT-references**