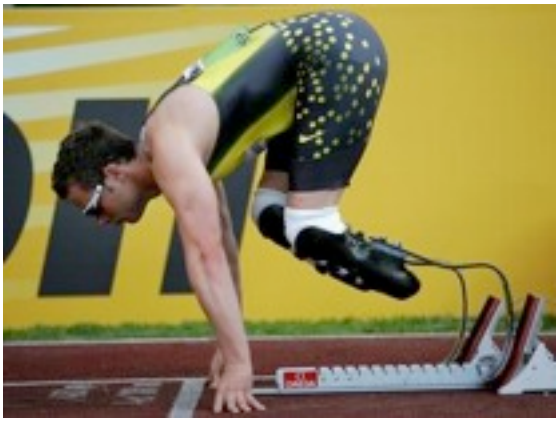

Does the use of prosthetic legs mean that non able bodied athletes have an advantage?

By Lauren Hall

Contents

Introduction to Prosthetic Limbs

Does the use of prosthetic legs mean that non able-bodied athletes have an advantage?

A Prosthetic limb attempts to fulfil the role of a natural leg and allow everyday actions to be carried out. They support the body and enable walking and running to be continued. Missing a limb can have an impact on your sporting life so prosthetics like the 'cheetahs' and 'Blades amongst others, allow the enjoyment to be continued. Some say however that, using prosthetics gives an athlete an advantage due to many reasons, on the other hand, others state that if anything they have a disadvantage. Everyone has there different view and opinion.

Introduction

Prosthetic limbs

- Many individuals wearing prostheses can comfortably sprint and run short distances.
- A prosthesis is an externally applied device designed to replace a missing part of the body or to make a part of the body work better.
- Prosthetic legs are used so that the individual may perform regular daily tasks more easily, helping them gain more independence and confidence as they carry on everyday life.
- When considering a prosthetic limb a few things must be considered:
  Amputation level of intended user
  Function of prosthesis
  Occupation of intended user (office job vs. manual labour).
  Activities of intended user (e.g. sports).

Cosmetic appearance of prosthesis
Financial resources of the patient.

Paralympics

- The Paralympics has inspired many and significantly raised the profile of disabled sports.
- These include:- (Summer) Archery, Athletics, Boccia, Cycling, Equestrian, Fencing, Football, Goalball, Judo, Powerlifting, Sailing, Shooting, Standing, Volleyball and Swimming
- As well as Table Tennis, Tennis, Wheelchair Basketball Wheelchair Rugby.
- In the winter it is possible to do Alpine Skiing, Biathlon, Cross Country & Sledge Hockey.
- However now some athletes for example 'Oscar Pistorius want to be able to compete with able bodied athletes but should this be allowed.

Athletics

- Some individuals will require a special leg with a running alignment to be able to compete in competitions.
- Some prosthetic legs are aligned just for running force so the runner can land on the ball of the foot.
- It is still possible to do most actions that someone with natural legs would do.
- Running can help you get back to a normal life and helps with rehabilitation.

These facts came from 'http://www.limblossinformationcentre.com/content/LLIC/index.html'
Pictures 'http://images.google.co.uk/imgres?imgurl=http://www.bbc.co.uk/blogs/olympics/pistorius46.jpg&imgrefurl'
'www.london2012.com/'
'teamusa.org/news/article/6681'
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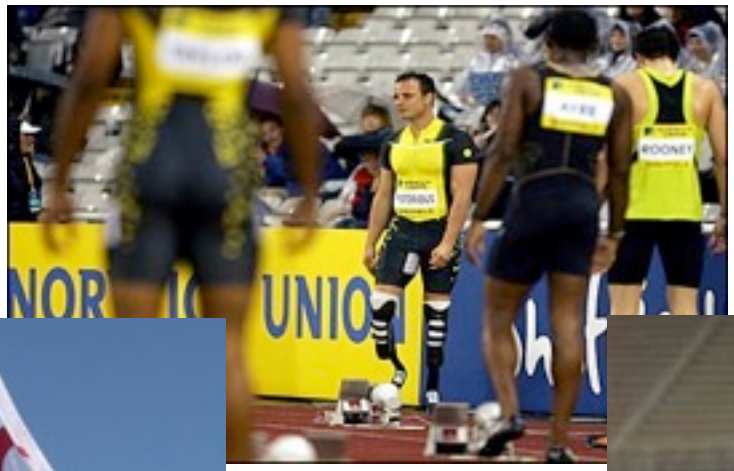


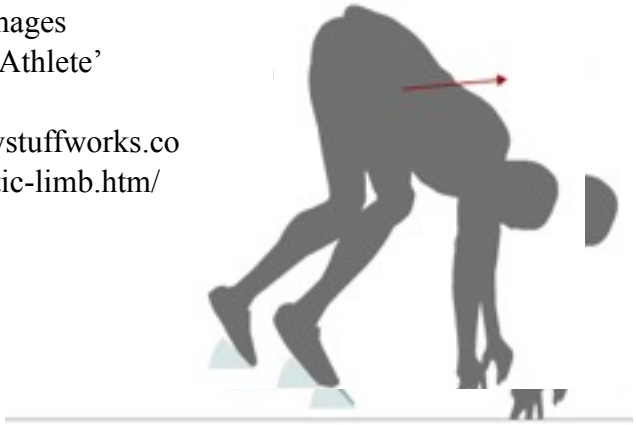
Argument 1

Prosthetic legs gives no advantage to the athlete

Claim 1

‘Using Cheetah Prosthetics means that the athlete has a reduced sense of balance.’
‘Jeffrey Kessler Athletics coaching association’
http://sports.espn.go.com/oly/trackandfield/news/story?id=3398915

Google Images
‘Amputee Athlete’
http://
health.howstuffworks.com/prosthetic-limb.htm/printable



It is important for athletes to get a good start off the blocks and without this, they could forfeit the race.

The Human bodies Balance system

Acting together our body using our response systems to continually interpret sensory information from all over the body and allow us to act on this information in a controlled way. Many different sense organs play a part in helping to maintain our balance.

The eyes

The eyes supply information about the positions and movements of the body.

Receptors

And as well as this visual response, the hundreds of stretch receptors detect the stretching of muscle fibres and other tissues. They are found in the muscles and joints. Skin pressure receptors such as those located in the feet sense what part of the body is down and touching the ground. This helps your sense of balance.

The Ears

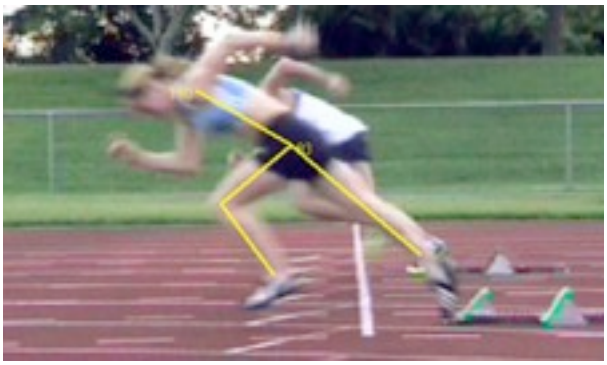
The main components of balance are the semi circular canals which are located in the ear. These are three curved tubes in the inner ear. These contain sense organs which detect changes in the direction of movements. However there is also the Utricles, these are fluid filled spaces of the inner ears. These contain sense organs which detect changes in the movement of speed. The Saccules also do the same job as the Utricles. Another component of the inner ear, monitor the direction of motion such as forward and backward and side to side.
Functions of semi circular canals, Utricles and Saccules studied from
'Illustrated Human and Social Biology' (Book)
B.S.Beckett

The Nervous System

The central nervous system (the brain and spinal cord) processes the main information from the four other systems to make some coordinated sense. This lets us keep our sense of balance.

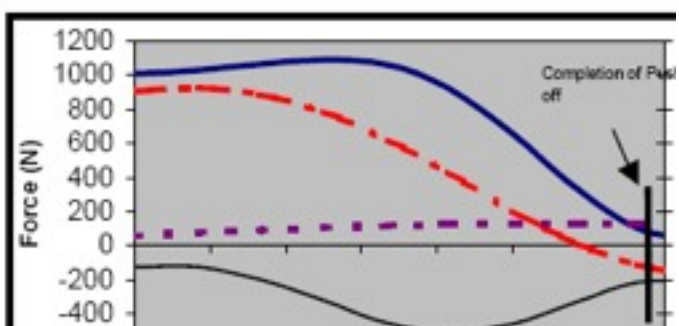
Claim 2
'The Athlete with the prothetic leg/legs must immediately stand straight up'

'Quoted from the German Sport University in Cologne investigating Prosthetics'
http://health.howstuffworks.com/prosthetic-limb.htm/printable



http://www.europaralympic.org/fit-soluciones/Img?imagen=1365316

The Body - Push off and speed



‘http://w4.ub.uni-konstanz.de/cpa/article/’

The Body

An Athlete with a natural leg would push off using there feet hips and calf muscles. They would keep tucked up to stay as low as possible. This means the athlete is more air resistant giving the athlete an advantage.

A non able bodied athlete however does not have this advantage however, as shown by the graph because to substitute the legs, the hips have to produce all the force to bring the knees up to the chest. Having this disadvantage means, they are less air resistant at the beginning slowing the athlete down.

Air resistance

The meaning of air resistance –

- Is the force of friction that slows down an objects moving through the air.
- The Friction that occurs between air and any object moving through it.

‘The Usborne Internet linked Science Encyclopedia Ted Smart Usborne publishings’

As the athlete runs the larger the surface area the less aero dynamic the athlete will be. Therefore when the non able bodied athlete has to stand up immediately they have a bigger surface that is hitting the air so the force is acting against them. Where as the able bodied athlete is able to stay low gradually bringing themselves up so therefore the force is not acting against them as much.

Having prosthetic legs does not give the athlete an advantage in this case because they are less air resistant and the force is acting on them more.

Claim 3

‘The Athlete with the prothetic leg/legs has a disadvantage on wet tracks’ ‘Jeffrey Kessler Athletics coaching association’

Friction

It is the force that slows down moving objects that are touching. Friction is useful in some situations; however, in others it is a total nightmare. If there was no friction between anything it would be impossible to grip. ‘The Usborne Internet linked Science Encyclopaedia Ted Smart Usborne publishing’s’

‘The Prosethetics have a general disadvantage on the track because they are like ‘ski’s’ the smooth undersides minimise friction with the track, however this makes them easy to slide’ Jeffrey Kessler Athletics coaching association http://sports.espn.go.com/oly/trackandfield/news/story?id=3398915

This means that the non able bodied athlete is prone to sliding giving them a disadvantage due to friction. They do have spikes on them like the normal athletes shoe, however because of the large surface area it is easy to slide as they do not cover the whole surface.

However for the able bodied athlete, the friction is good, meaning they can maintain grip even when it is wet due to spikes on the toes. As the shoes do not have smooth undersides the friction acts enough so the athlete does not slip but does not act enough to completely show they down.
Friction gives non able bodied athletes a disadvantage.

Argument 2

Prosthetic legs gives an advantage to the athlete

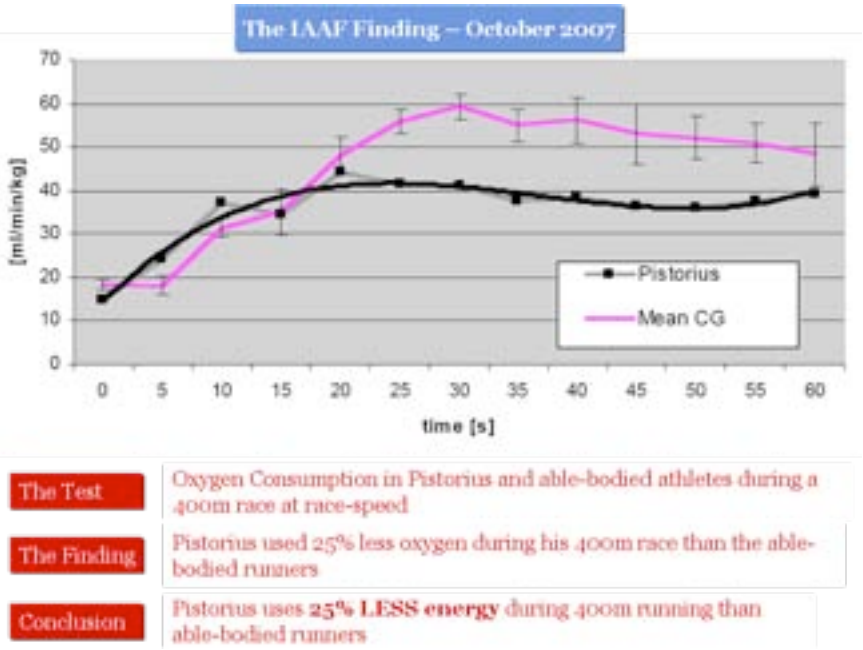
Claim 1

'An athlete using this prosthetic blade has less Oxygen Consumption than an able bodied athlete during a 400m Race.'

The IAAF (International Association of Athletics Federations) Statement http://www.timesonline.co.uk/tol/sport/more_sport/athletics/article3184427.ece News article.

The IAAF (International Association of Athletics Federations) Statement

Image



'www.sportsscientists.com/2008_07_01_archive.html'

Respiration

Respiration is the release of energy from food chemicals. There are two types of respiration

- Aerobic respiration
  Aerobic respiration releases energy through the breakdown of glucose molecules, by combining them with oxygen inside living cells. The majority of organisms re respire aerobically and it is the main method of releasing energy from food chemicals. Humans aerobic respiration equation is
  Glucose + Oxygen = Carbon Dioxide + Water + Energy realeased

However when looking at sprinting we use Anaerobic respiration

- Anaerobic respiration
  This takes place without oxygen and in humans the equation is this
  Glucose = Lactic acid + The energy Realeased
  When exercising Hard, eg. Sprinting not enough oxygen can get to the muscles so aerobic respiration cannot take place, Instead this kind of respiration occurs which produces short bursts of energy.

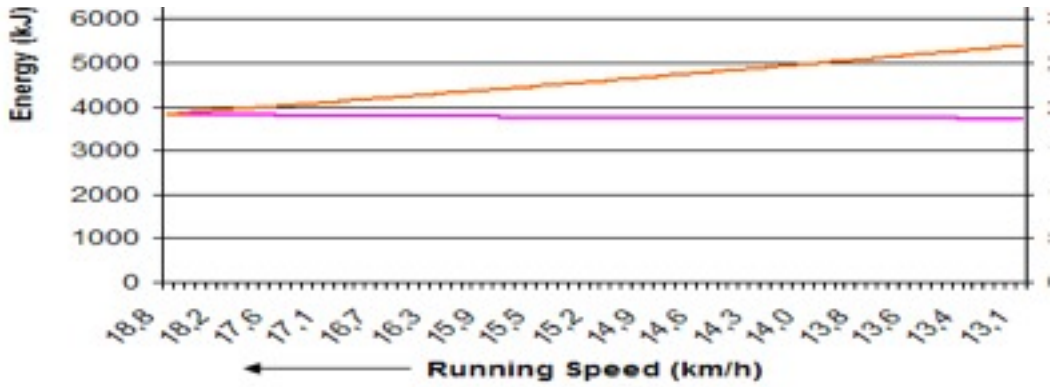
During exercise such as athletics, muscles require a faster supply of glucose and oxygen. These substances are transported to the muscles via the blood. Respiration is increased and due to the increase in glucose and oxygen the muscles are able to move and work faster.The faster rate of respiration also produces more carbon dioioxide as a waste product. Therefore more blood needs to be pumped around the body to remove the waste product.

Using 25 percent less oxygen means that the body is not having to work as much so can run quicker because it is using less energy. Whereas the able bodied athlete has to use this 25 percent of oxygen therfore slowing the athlete down.
This is a disadvantage to able bodied athletes.

Claim 2

'As well as this, the energy loss in the blade is significantly lower than in the human ankle joints in sprinting at maximum speed. An athlete using this prosthetic blade has a demonstrable mechanical advantage (more than 30 per cent) when compared to someone not using the blade.'

http://www.timesonline.co.uk/tol/sport/more_sport/athletics/article3184427.ece



‘http://www.2peak.com/tools/hawaii3.php’

Kinetic energy

The faster an object moves, the more kinetic energy it has. As it slows down, it loses

Kinetic energy.

Having the energy loss in the blade being so low means that the non able bodied athletes have an advantage this is because the body does not have to work so hard to regain back the energy that it has lost, whereas the able bodies athlete has to work twice as hard to regain any energy it has lost whilst doing the other jobs in the body. This slows down the athlete. The non able bodied athlete has more kinetic energy.

Claim 3

‘The prosthetics give the athlete an unfair advantage by making the athlete taller than they would be on natural legs and so therefore lengthening the athletes stride.’

‘http://health.howstuffworks.com/prosthetic-limb.htm/’

Running Action

Humans actually leap from one leg to the other while running. Each leap raises the center of gravity during take-off, and lowers it on landing as the knee bends to absorb

the shock. At mid arc, both feet are momentarily off of the ground. Running uses more energy than walking to travel the same distance.

Lower body motion

Running is executed as a sequence of strides, which alternate between the two legs. Each leg's stride can be roughly divided into three phases: support, drive, and recovery. Support and drive occur when the foot is in contact with the ground. Recovery occurs when the foot is off the ground. Since only one foot is on the ground at a time in running, one leg is always in recovery, while the other goes through support and drive. Then, briefly, as the runner leaps through the air, both legs are in recovery.

When sprinting, runners stay on their toes bringing their legs up, using shorter and faster strides.

So therefore having a longer stride increases the distance that the athlete travels so this therefore gives the non able bodied runner an advantage. Meaning they could run the race a lot quicker than what an able bodied runner could.

Critical Analysis

Argument 1
Claim 1 - Balance

Comparing the two sense systems of a non able bodied athlete and an able bodied athlete it is clear that the prosthetic legs give no advantage to the athlete. This is because of the way the prosthetics work, the whole body system can still work the same however because the legs are not natural, it makes the athlete unbalanced. They are thin and don't have the same muscle built as a natural leg, this means that the non able athlete have a disadvantage as they are unstable. The rest of the body's different sense organs can not communicate with the prosthetic leg like a natural leg so may be unstable. The bodies senses system and organs may not work the same therefore proving the prosthetic legs give no advantage to the athlete.

Claim 2 - Air resistance
Looking at the research on the air resistance of the two athletes it shows that the non able bodied athlete have to stand up immediately, whereas the able bodied athletes stay low. This gives the able bodied athletes an advantage. This is because the able bodied athletes are more air resistance. They are more aerodynamic and the force is not acting against the athlete so much.

Claim 3- Friction
The non able bodied athlete is prone to sliding giving them a disadvantage due to the friction, because of the larger surface area it is easier for the athlete to slide. However for the able bodied athlete the friction is enough so they don't slide but doesn't affect them as much so that they slide. Friction gives the non able bodied athletes a disadvantage but if it wasn't there, there would be no grip at all.

Argument 2
Claim 1 - Oxygen
Using 25 percent less oxygen means that the body is not having to work as much so can run quicker because it is using less energy. Whereas the able bodied athletes because they use the 25 percent of oxygen so the body is doing more work. This slows the able bodied athlete down giving the non able bodied athlete an advantage.

Claim 2 - Kinetic energy
Having the energy loss so low means that the non able bodied athlete has an advantage because the body doesn't have to work so hard to regain becak the energy that it has lost whereas the able bodied athletes have to work twice as hard to regain any energy.

Claim 3 - Athlete is taller
When the Athletes sprint, they stay on their toes, bringing their legs up, using shorter

faster strides. So therefore having a longer stride increases the distance they can run so therefore gives the non able bodied runners an advantage.

My Conclusion

From the evidence that I have collected, I believe that non able bodied athletes do not have an advantage over able bodied athletes. This is because the evidence for the first argument is stronger and is clearly more critical of the argument than the second argument. However on the other side there is enough evidence for others to believe the other side of the argument and in different situations each opinion would be valid.

Eg. Oscar Pistorius
It was ruled by the IAAF that he couldn't run due to an advantage, however he won the appeal and was allowed to run, but due to the wet track he had a disadvantage and didn't qualify.

In each different situation can be judged differently, however it is still a big question whether non able bodied athletes have an advantage. Also whether they indeed should be able to run with able bodied athletes if they wish to. However some say able bodied athletes are not allowed to compete in the Paralympics so why should able bodied athletes be able to compete in the Olympics. It is still a widely controversial topic.

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