2020

Ergonomic Concept

SQlab
SPORTS ERGONOMICS

Editorial

Listen to your body

If you are experiencing discomfort of any kind, you must pay attention. SQlab's team relentlessly studies ergonomics in an effort to make your cycling experience more enjoyable.

Retailers

Ask your dealer. At www.sq-lab.com you will find our Top 500 ergonomics experts under "Dealer search". These dealers are regularly trained by us and usually have a lot of experience in ergonomics in cycling.

Founder and managing director Tobias Hild tests all products on the local Isartrails himself.

Dr. Stefan Staudte, urologist and former extreme biker, plays a decisive role in the design of the saddles in order to protect the sensitive areas of both men and women.

SQlab researches

Under the direction of our two doctors, Dr. Stefan Staudte (urologist and extreme biker) and Dr. Markus Knöringer (former vice European champion in surfing - specialist for neurosurgery, intervertebral discs and spine surgery), we have already carried out several studies and test series in the SQ laboratory.

The findings are then translated into our next new product design by the product management team.

At SQlab, four young scientists and one engineer do nothing but research, measure, test, and evaluate.

In addition, several research projects with universities of applied science have been developed into successful SQlab products. Reliable, proven, reliable:

Intensive research pays off. In contrast to most other ergonomics and saddle brands, we are sticking to our concepts right from the very beginning.

SQlab develops

The results of our research team flow seamlessly into product management. Three industrial designers as well as four product managers translate the findings from the SQlab laboratory into product.

Our process has been streamlined from many years of teamwork and co-operation between R&D and Product Management. Nevertheless, we take our time to optimize every product that comes from SQlab.

For example, in our grip series, we drew over a hundred examples and repeatedly printed, tested, modified, measured and adapted samples until all concepts were identified and invented.

The SQlab product management consists of doctors, scientists, engineers but also athletes.

SQlab tests

In the development phase, we regularly carry out tests at renowned test institutes in Germany and take random samples during production.

These samples are tested against our in-house test machine.

From the shorts padding to downhill handlebars, we can test everything up to the total failure of the component.

But the most important thing for us are the practical tests.

Since racing cyclists usually train their whole lives to suppress pain, they are often not so well suited to assess ergonomics.

That's why we've created our SnaQe Team. The SnaQe team consists of 200 regular cyclists, doctors, ex- professionals and even rock stars make up our international test team.

All members are able to test and evaluate prototypes subjectively according to their own experience, because every body is different... and close to our hearts.

Timmy C. bassist of the rock band "Rage Against the Machine", has been part of the SQlab SnaQe team for several years.

The pelvis

The pelvis is the central point in the body. From above, the spine flows into the pelvis via the sacrum.

The thigh bones are rotated laterally in the hip joint, which is usually more sensitive to pressure.

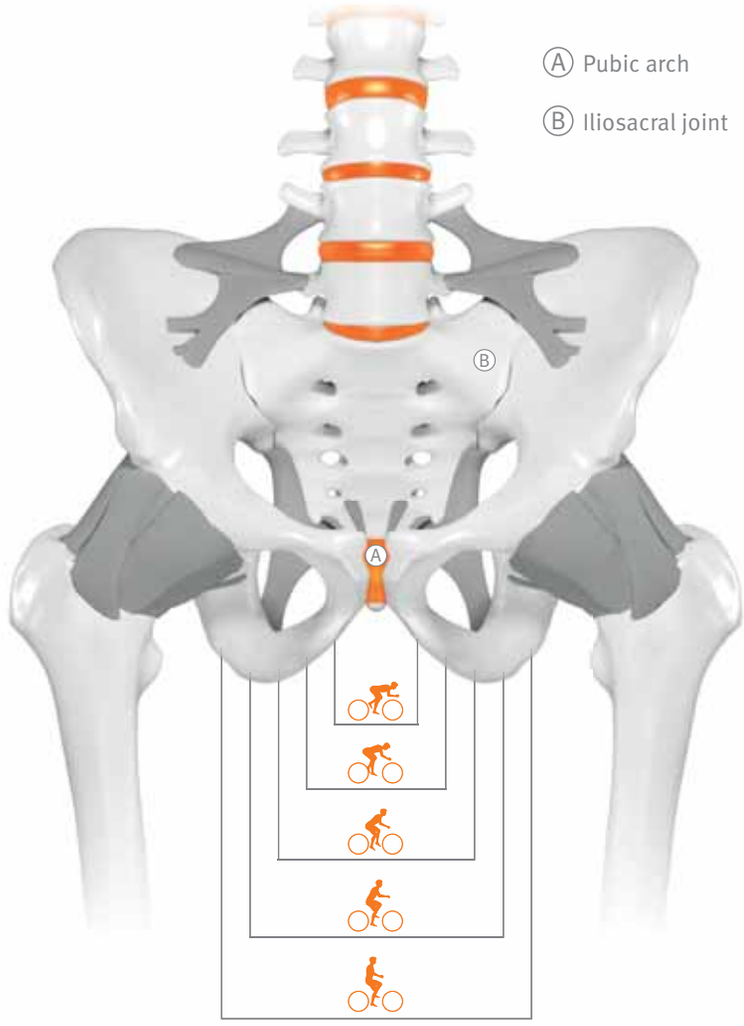
During normal sitting, the sit bones serve to absorb the body weight and can absorb high pressure.

This should also be the case when cycling. In an aggressive sitting position, the pressure shifts from the ischial tubercles to the front and rolls over the ischial branches to the pubic branches. The pubic knots converge in the pubic arch.

In both men and women, the central perineum area is also supported. The ischial knots and pubic knots converge from the widest point of the sit bones in an inverted V upwards.

This means that the more aggressive the sitting position, the narrower the bicycle saddle should be.

In 2002, we developed a simple formula to calculate the perfect saddle width from the distance between the sit bones depending on the sitting position.



Sitting Positions

+0 cm Triathlon: This sitting position corresponds to that of the very stretched triathlon rider.

+1 cm Stretched: This sitting position corresponds to the position on the drop handlebar of the racing bike or that of the marathon rider, whose saddle is usually higher than the handlebar.

+2 cm Moderate: Saddle and handlebar are at about the same height, which corresponds to the moderate sitting position. Both the MTB rider and the sporty trekker usually sit in this position.

+3 cm Slightly bent forward: The comfortable trekking and city bike rider usually sits slightly bent on his bike. But also the Enduro rider often sits in this rather upright position.

+4 cm Upright: The completely upright sitting position is used mainly on the City bike.

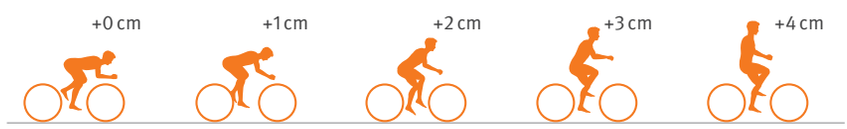
Determination of the saddle width

1. Step
Sit on a stool or chair with a piece of measuring paper, with the back upright and shoulders back. Slightly elevate your feet by placing them on a few books or the chair rail. Pull yourself down onto the stool to create more pressure.

2. Step
Measure the sit bone distance from center to center.

You can also be measured at your local SQlab dealer with the SQlab knob plate or with measuring cardboard.

3. Step
Select your right sitting position from the positions shown and add the corresponding value to the measured sit bone distance.



Sitting position triathlon	Sitting position stretched	Sitting position moderate	Sitting position slightly bent forward	Sitting position upright
	Road Bike drops	Road bike top handlebar Cross Country Trekking Sport	Enduro Trekking City	Dutch bike City

4. Step
Choose a suitable saddle in the correct width.

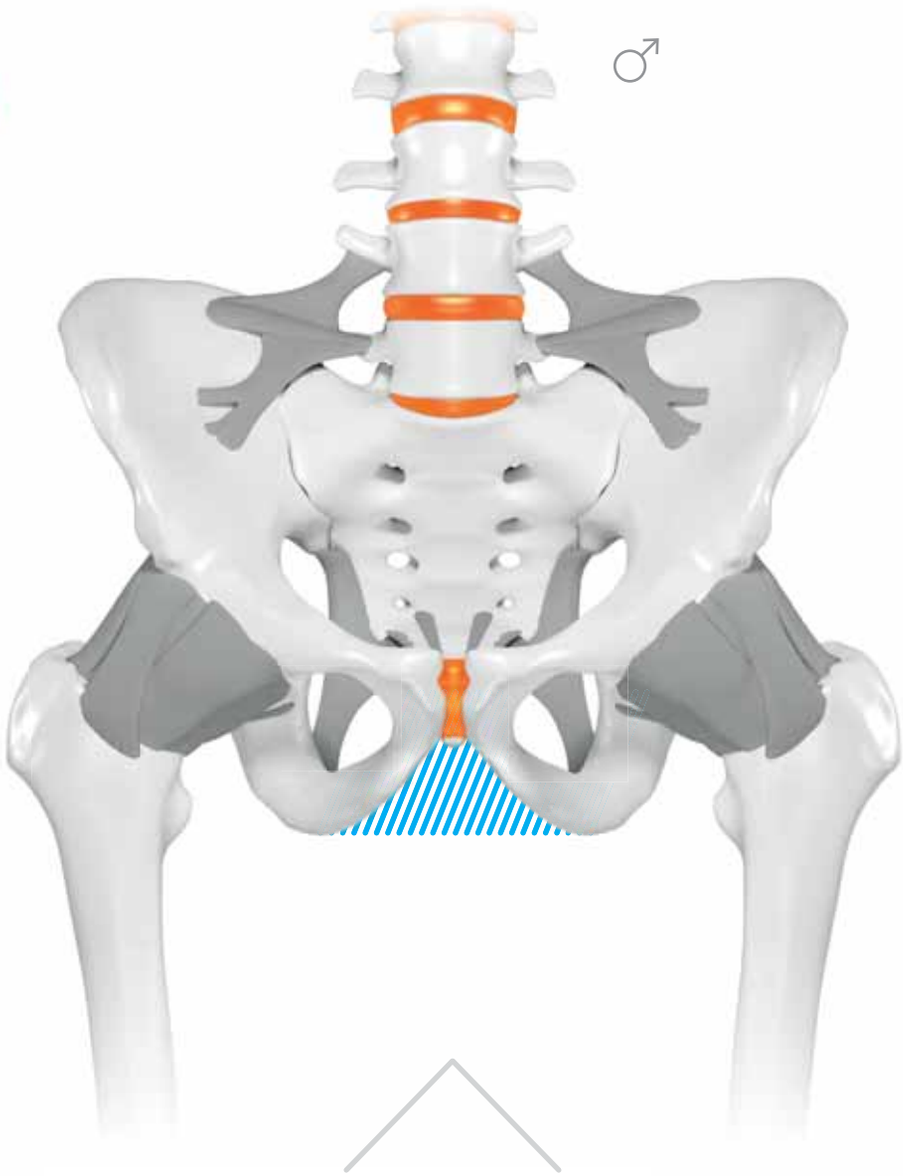
The following special regulations apply to 621 City/Comfort Series saddles:
Sit bone distance less than or equal to 12 cm » Saddle width 18 cm.
Sit bone distance greater than 12 cm » Saddle width 21/24 cm.

We recommend measuring the sit bones and purchasing ergonomic products from SQlab dealers.

Man vs. Women

The pelvis of men and women differ due to the fact that a woman's pelvis needs to be able to facilitate giving birth.

However, the contact points of the sit bones in men and women are more similar than one may assume.

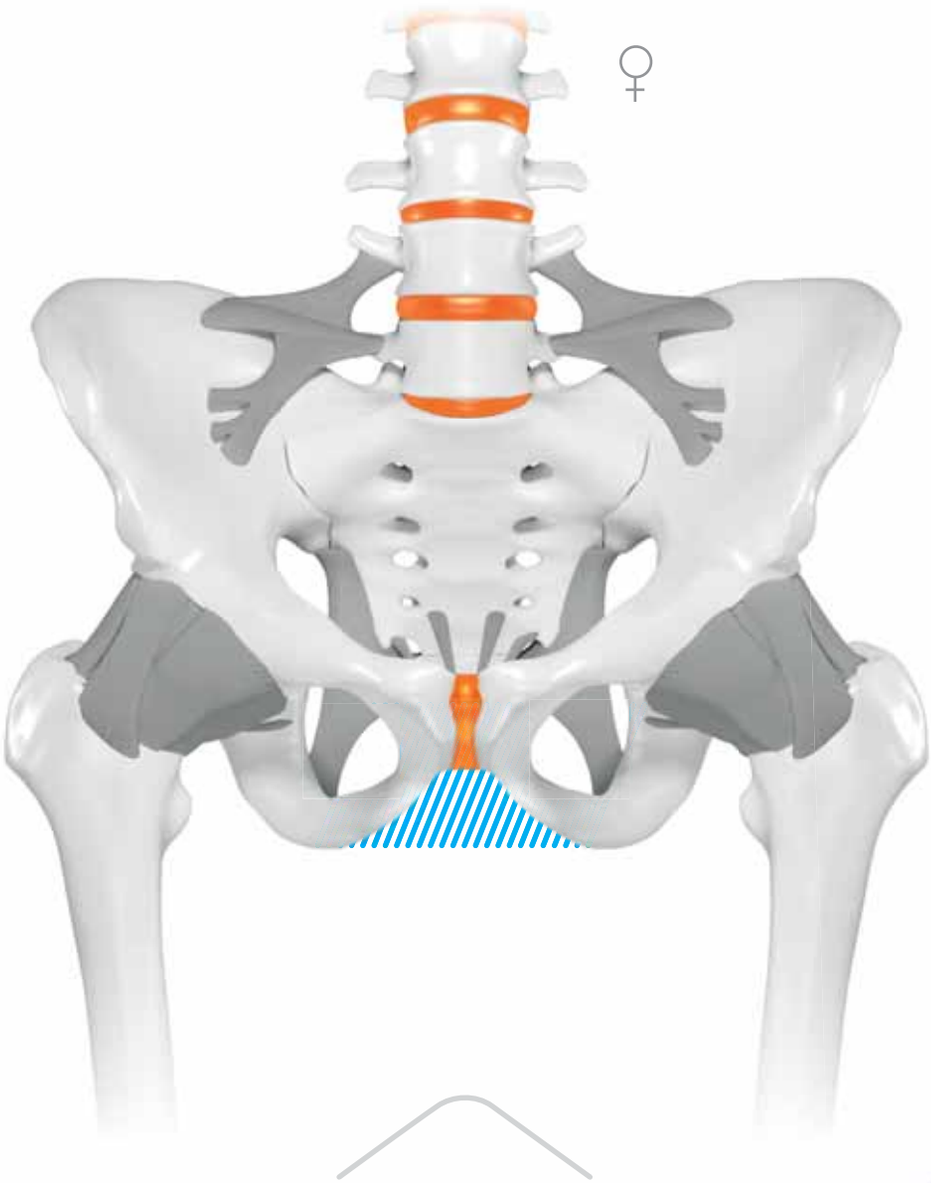


Man with a steep, upright pubic bone.

The previously rarely considered anatomical difference of a woman's lower positioned pubic bone arch often leads to high pressure experienced on the saddle nose.

So, there are many women with a small sit bone distance and many men with with a large distance.

Measuring the distance between sit bones at your SQlab dealer makes it easier to choose the right saddle and saves unnecessary test rides. Different saddles for men and women are no longer needed with the SQlab concept! The lower saddle nose relieves the typical problem zone for men and women alike.



Woman with an lower positioned pubic arch. The sit bone distance of a woman is not necessarily wider than the distance of a man.

Numbness (Man)

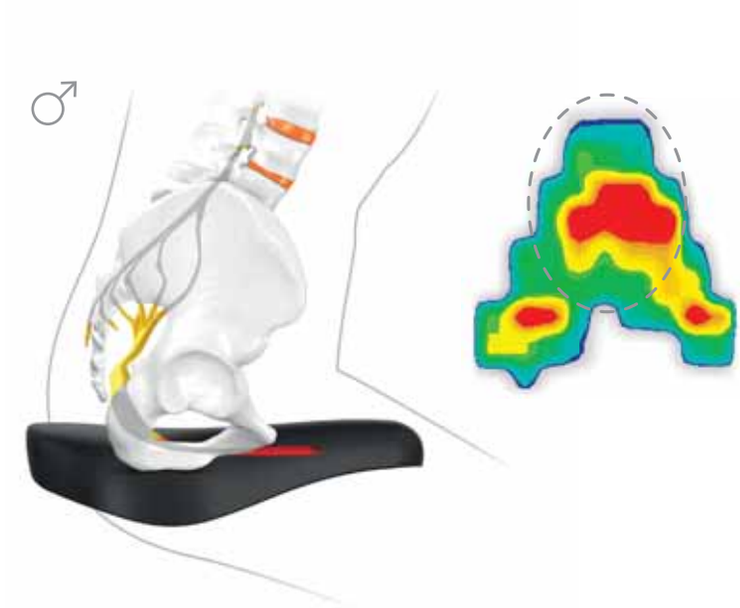
Numbness often appears as a symptom of compressed nerves and/or reduced blood flow in the perineal area.

Special nerves and blood vessels in the perineal area of men are responsible for the erection. If the blood supply to the nerves is reduced, or they are com pressed for extended periods of time, it can lead to reduced sexual performance.

This process is reversible, as after a longer period off the bike this process is usually reversed and normal sexual performance returns.

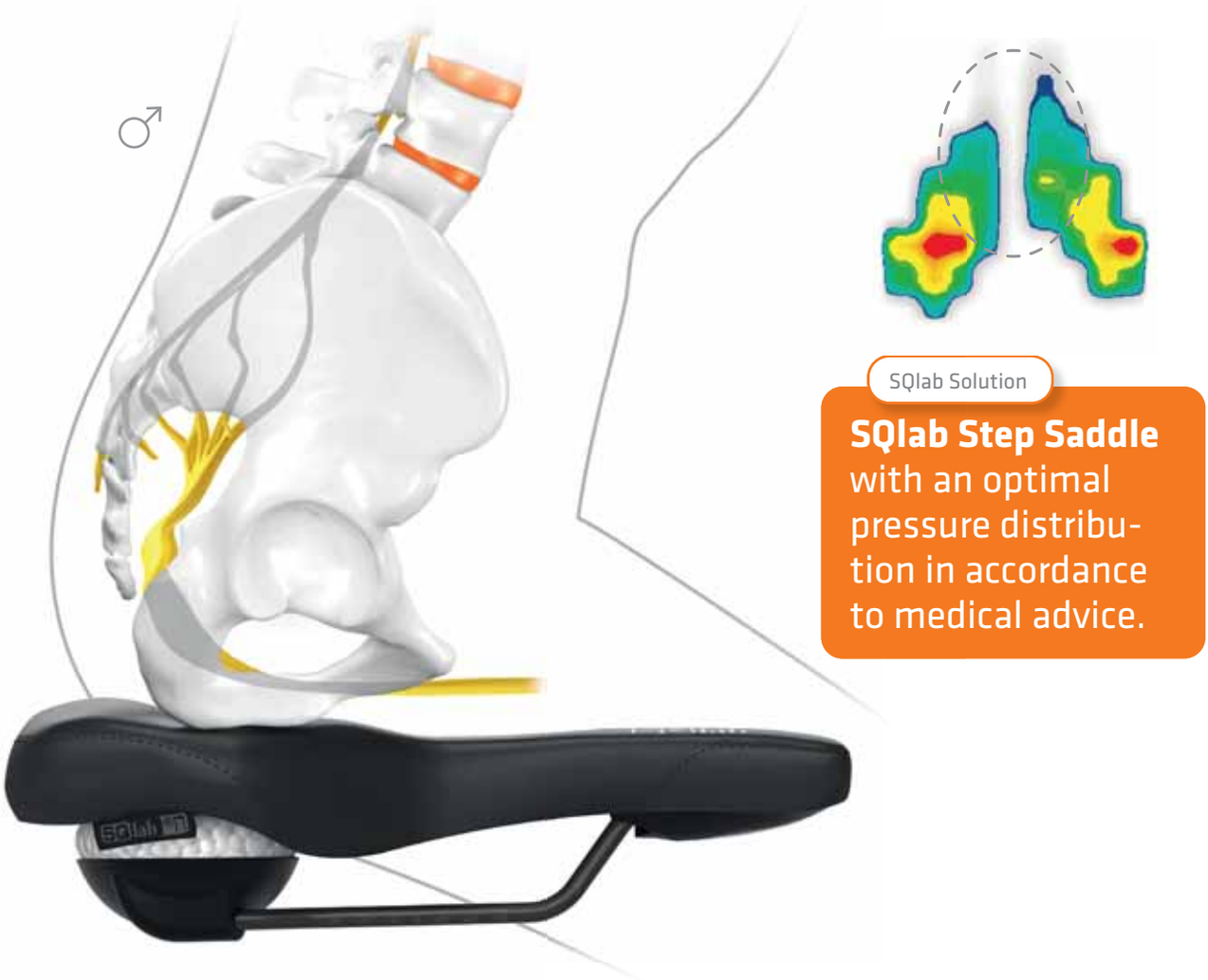
Caution! The problem can become chronic. Numbness is an alarm signal! Those who listen to their body can minimize the risks so that the positive effects of training prevail.

Cycling is a fantastic heart- circulation-training and hence improves sexual performance.



Cause

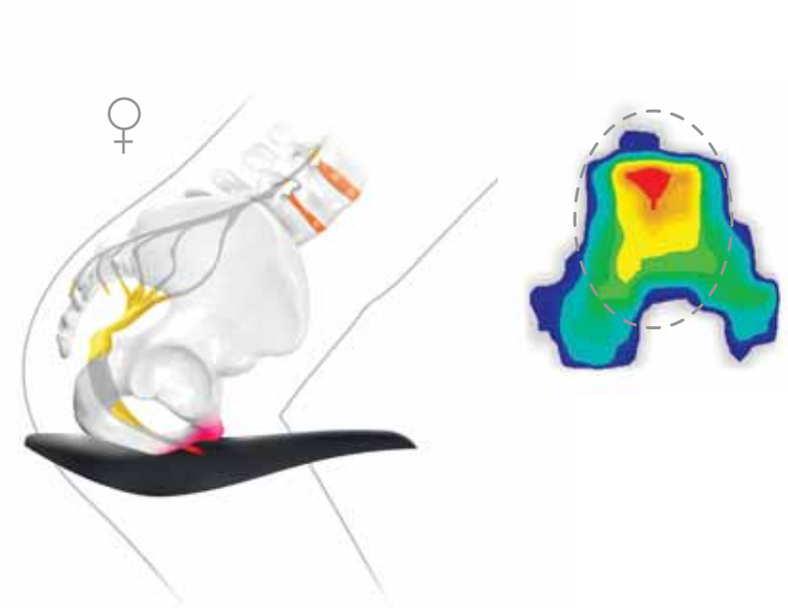
Conventional saddle
too much pressure in the soft tissue.



SQlab Solution

SQlab Step Saddle
with an optimal pressure distribution in accordance to medical advice.

Pressure on the pubic arch (Woman)



If one compares the pressure mapping images, the conventional saddle shows clear pressure peaks in the area of the pubic arch/saddle nose.

The pressure image of the SQlab step saddle with the lower saddle nose shows that the center of pressure lies on the sit bone and not on the sensitive pubic arch.

The pressure on the sit bone can be a little unpleasant at first, until you become familiar with your saddle.This is because SQlab saddles are designed for your weight to be dispersed on the sit bones, rather than the soft tissue areas.

Cause

Conventional saddle
too much pressure on the pubic arch arch.

SQlab Solution

SQlab Step Saddle
with a lowered saddle nose.

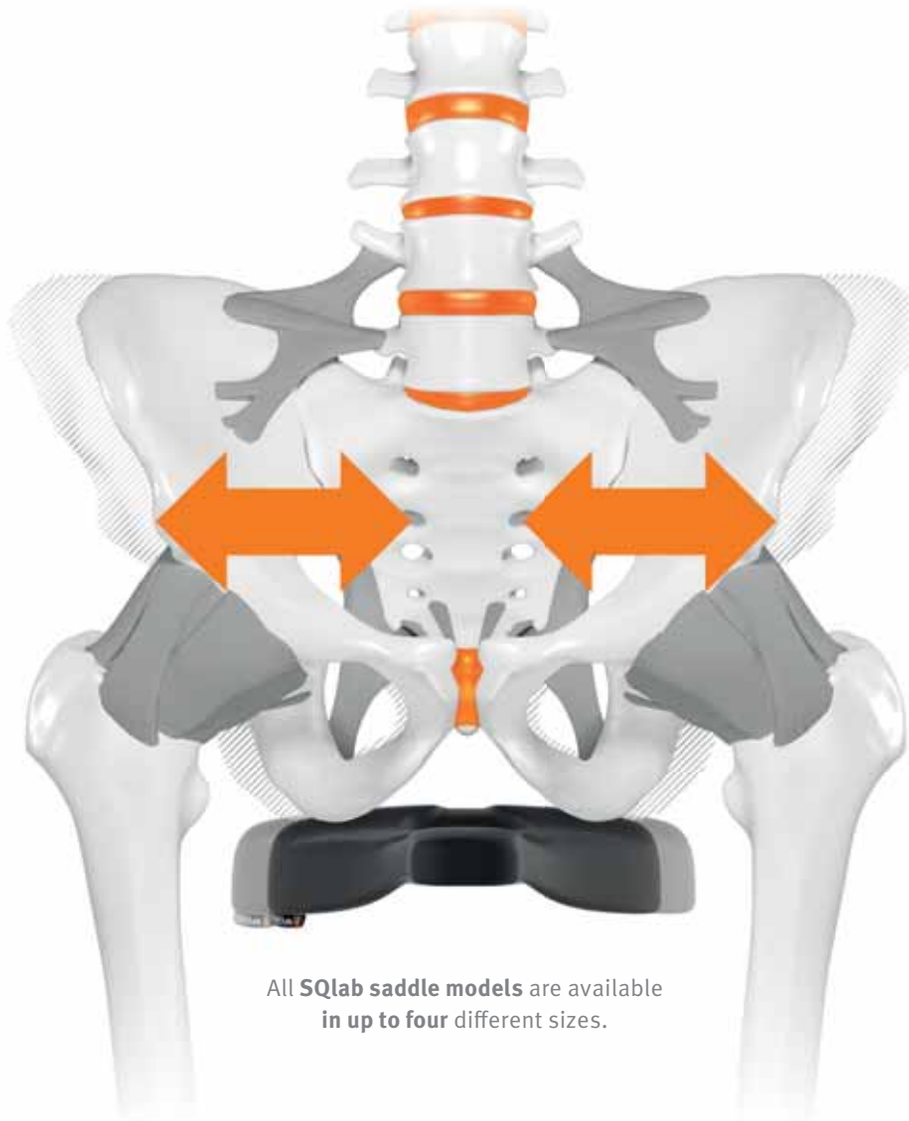
Sit Bone Pain

If a saddle is too narrow, the pressure is applied in spots where it shouldn't. Back in 2002, SQlab was the first saddle manufacturer to introduce a system to measure the distance between the sit bones and to calculate the optimal saddle width.

1. Cause

Narrow Saddle
A saddle which is too narrow leads to discomfort to the sit bones and an increased pressure on the perineal area.

The optimal saddle width guarantees that the sit bones lie completely flat on the saddle. This is the only way in which pressure is relieved on the sensitive area in men and on the pubic arch in women.



All **SQlab saddle models** are available **in up to four** different sizes.

SQlab Solution

Sit Bone Measurement
for more comfort, less pressure and better Efficiency.

A soft saddle usually becomes very uncomfortable after approx. 30–45 minutes on the bike.

The sit bones sink in so far, that sensitive soft tissue such as muscle and tendons are aggravated, causing a deep, dull, pressing pain.

Due to the deep sinking of the sit bones, the perineum area of men and the lower pubic arch of women are also subject to higher pressure. A softer pad "seals" the blood flow. Soft saddles are not bad, but are usually only suitable for short distances.

Ⓐ Sit bones get used to the load.

Ⓑ Deep-seated muscles and tendones are stimulated by soft pads.

2. Cause

Soft saddle
leads to sinking in sit bones.

SQlab Solution

SQlab offers
firm saddles for different Areas of application.

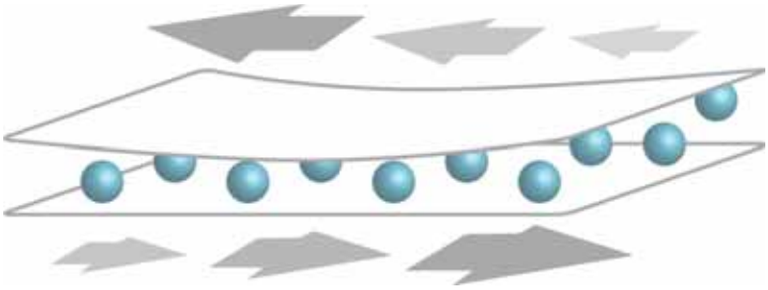
In the long run, the sit bones become accustomed to a pressure load and pain is reduced. At the beginning of the season, after long breaks or in the case of an unusual, new saddle shape, pain in the sit bones is normal. Getting used to a new bicycle saddle often requires five to six rides. A break of at least two days should be taken between the first rides, as the already irritated periosteum as well as muscle and tendon insertions react much more sensitively.

3. Cause

Missing Familiarization
periosteum, muscle and tendon approaches react irritably.

SQlab Solution

Regular Cycling
leads to familiarization.



Functionality of the shear force absorbing TPE layer.

How does the pain come about? The shear forces caused by the pedaling motion and friction often cause pain.

The slight but constant movement of the pelvis on the saddle provides painful shearing forces on the periosteum.

Since a saddle needs a rather stable, firm cover, the shear forces are absorbed better here.

For this reason, we have developed various cycling shorts pads. On the side facing the saddle there is a very thin layer of an orthopedic shearing gel, which is used in similar form in prostheses.

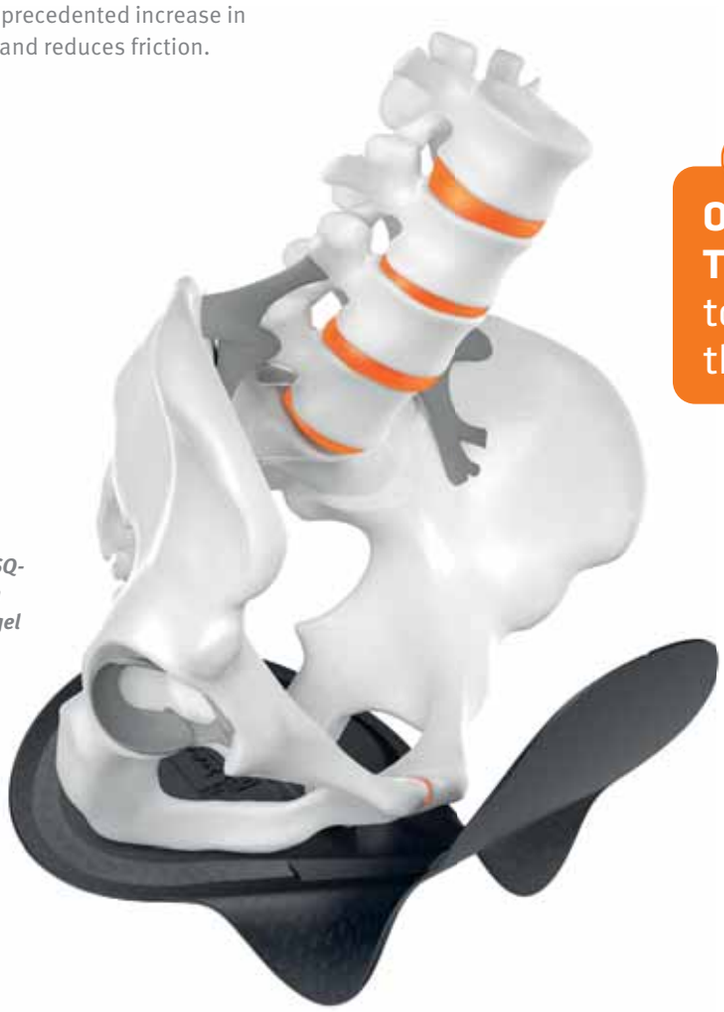
In combination with a very thin layer of a special, very firm foam above it, this results in an unprecedented increase in sitting comfort and reduces friction.

4. Cause

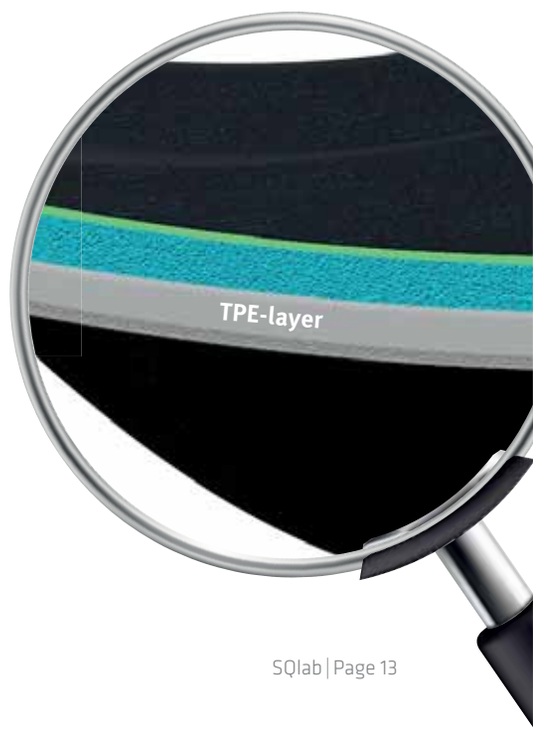
Shear forces
are caused by the alternating loading of the pedalling movement.

SQlab Solution

Orthopaedic TPE- inlay,
to absorb the shear forces.



MTB-Pad of the SQ-Short ONE11 with TPE-shear force gel



Despite the very flat, only 6/8 mm thick construction, the ONE11 and ONE10 pads conceal several coordinated layers.

The TPE shear force gel can optimally unfold its ability to absorb horizontal movements on the pad underside.

Back Pain

Walking is what the human body is designed for when it comes to movement. In order to be able to move forward with ease, the body is equipped with the ingenious pelvic swing system. The pelvis is tilted with every step, and the spine reacts with a movement to the opposite side.

This lateral movement of the spine should be maintained when cycling. The SQlab active saddle technology makes it possible to move the pelvis in the horizontal plane. In this way, the strain on the lower lumbar spine in the pelvis and hip area can be reduced.

Cause

Spinal Disc Problems
Back problems are very diverse and cannot be treated here completely. Unfortunately, the most common cause is a lack of exercise.

SQlab Solution

active-Saddle Technology
for a physiologically correct movement of the pelvis.

SQlab active-Saddle Technology

In spring 2010 the SQlab active saddle technology was introduced with the MTB saddle 611 active. Since 2011, at least one active model is available for every application.

Now over half of SQlab saddles sold is equipped with active technology. The active system is designed to allow the pelvis to move horizontally.

This ensures that the so-called pelvic swing is carried out in the same way as when walking naturally. The possibility of moving the pelvis along with the patient minimizes the risk of discomfort in the lower lumbar spine, pelvis and hips and provides targeted relief for the intervertebral discs and facet joints.

For the targeted strengthening of the back muscles, we have developed the SQlab Back Primer in cooperation with Dr. Markus Knöringer, specialist for neurosurgery, intervertebral discs and spine surgery.

Dr. med. Markus Knöringer
Medical specialist for neurosurgery, spinal disc and column surgery, sports medicine

Each SQlab saddle is available as active version.

Sitting maximizes comfort – the right way

Well over half of all cyclists complain of back pain. The best thing you can do for your back (which is plagued by predominantly sitting activity) is exercise. Cycling is a more sedentary which can be hard on your back. Through the SQlab active saddle technology, sitting when cycling mimics walking and the intervertebral discs are relieved. In addition, the comfort at the sit bones increases. From a bio- mechanical point of view, the efficiency of the pedalling movement increases.

SQlab Tip

Balance Exercises
as on the therapy spinning top or, for advanced users, on the slackline, train the deep back muscles, which are otherwise difficult to reach. Our active saddles function according to the same principle. Slackline and therapy spinning tops are limited available from us.

Hand

Holding, steering, and braking are the most important tasks that the bicycle grip must transmit, and it should be comfortable at the same time. Only a grip that fits the hand perfectly and relieves the nerves can fulfill all these tasks. We have developed a method to determine the optimal grip distance. Our grips are available in up to three different sizes.

Ⓐ **Carpal tunnel exit**
one of the most sensitive areas of the hand

Ⓑ **Medianus nerve**
supplies thumb, index and middle finger, runs through carpal tunnel

Ⓒ **Carpal tunnel**

Ⓓ **Carpal band**

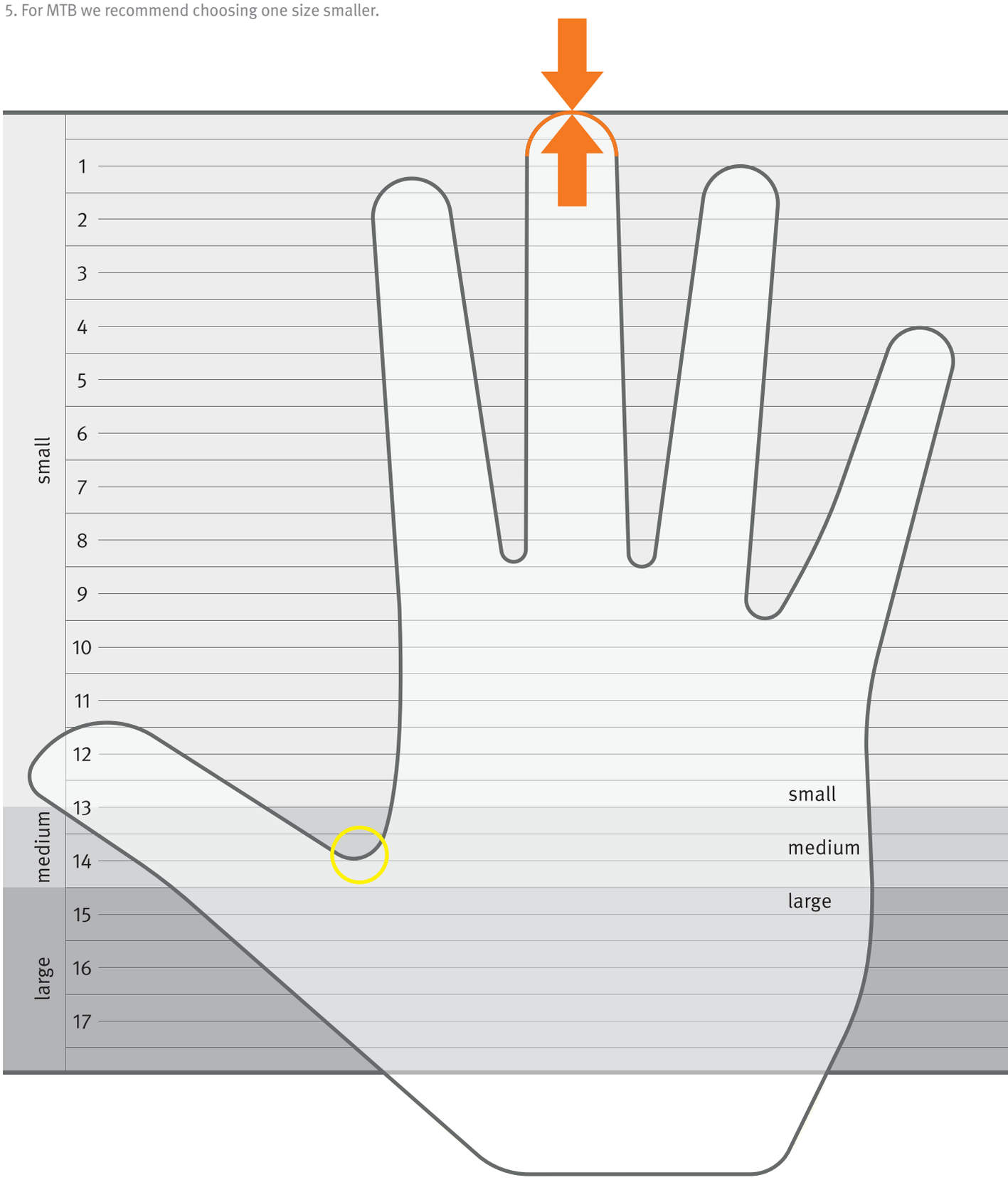
Ⓔ **Ulnar nerve**
supplies the two small fingers

SQlab Grip Size Template

since 2006

How it works ...

1. Place your hand on the image and position the middle finger at the arrow.
2. Stretch the thumb to the side.
3. Mark the bottom most point between the thumb and index finger.
4. Note the size and select the grip.
5. For MTB we recommend choosing one size smaller.



Numbness of the fingers

1. Cause

Too much pressure on the outside of the hand.
numbness in the ring finger and the little finger.

Numbness in the ring finger and the little finger is caused by excessive pressure on the outside of the hand. Pressure mapping shows that the maximum pressure usually occurs on the outside of the palm of the hand. At this point the ulnar nerve runs, which is responsible for the sensitivity of the ring finger and the small finger.

In order to reduce the pressure on the outside of the hand, we at SQlab have made the contact surface as large as possible. The grip was flattened at the top and pulled forward and backward so that the surface is as large as possible, depending on the area of use.

2. Cause

Too much pressure on the carpal tunnel exit.
Numbness in index finger, middle finger and thumb.

The cause of numbness in the index finger, middle finger and thumb is excessive pressure on the carpal tunnel outlet. Often caused by excessively large relief wings which relieve the ulnar nerve but under unfavorable circumstances strain the median nerve. The relief of the carpal tunnel, especially the carpal tunnel exit, is not self-evident with ergonomic grips. This is exactly where we have placed great value on. The relief wing must be placed as far outside as possible in order to keep the carpal tunnel exit as free as possible and to reduce the pressure. In addition, the gripping and supporting of the carpal tunnel is facilitated and at the same time ensures a secure grip.

SQlab Solution

Relief
of the ulnar nerve/carpal tunnel exit by a SQlab relief wing placed far outside.

The graphics shown serve to illustrate the nerve tracts in our hand and are not accurate.

In anatomy, the nerve tracts can only be seen from the underside of the hand and not from the top.

The cause of numbness in the index finger, middle finger, or thumb is an overstretched wrist that can narrow the carpal tunnel.

Similar to a kinked garden hose, through which no more water flows, the nerve information can no longer be transported through the narrowed carpal tunnel. This "bend" is usually caused by a handlebar that is too straight with minimal backsweep.

3. Cause

Lateral overstretched wrist
numbness in the index finger, middle finger and thumb.

SQlab Solution

Handlebar
with more backsweep for a straight transition from forearm to hand.

16° Backsweep

For a stretched sitting position on the Hardtail
or XC.

- The 16° Backsweep ensures a straight transition from forearm to hand when sitting in an extended position.
- The upsweep determines the elbow position for an active riding style.

12° Backsweep

For a more upright riding position on All Mountain
and Enduro.

- The 12° Backsweep ensures a straight transition from forearm to hand in a short reach and rather upright sitting position and protects the wrist from the extreme stresses of downhill.
- The 4° Upsweep determines the elbow position for active riding.

Grip safety

The relief wing must be placed as far out as possible in order to keep the carpal tunnel exit as free as possible and to reduce the pressure. In addition, the far outer position of the relief wing improves grip, especially when leaning forward. The fingers can fully enclose the grip through the external relief wing and the optimum grip size.

1. Cause

Too large relief wing
Grasping can be difficult in dangerous situations.

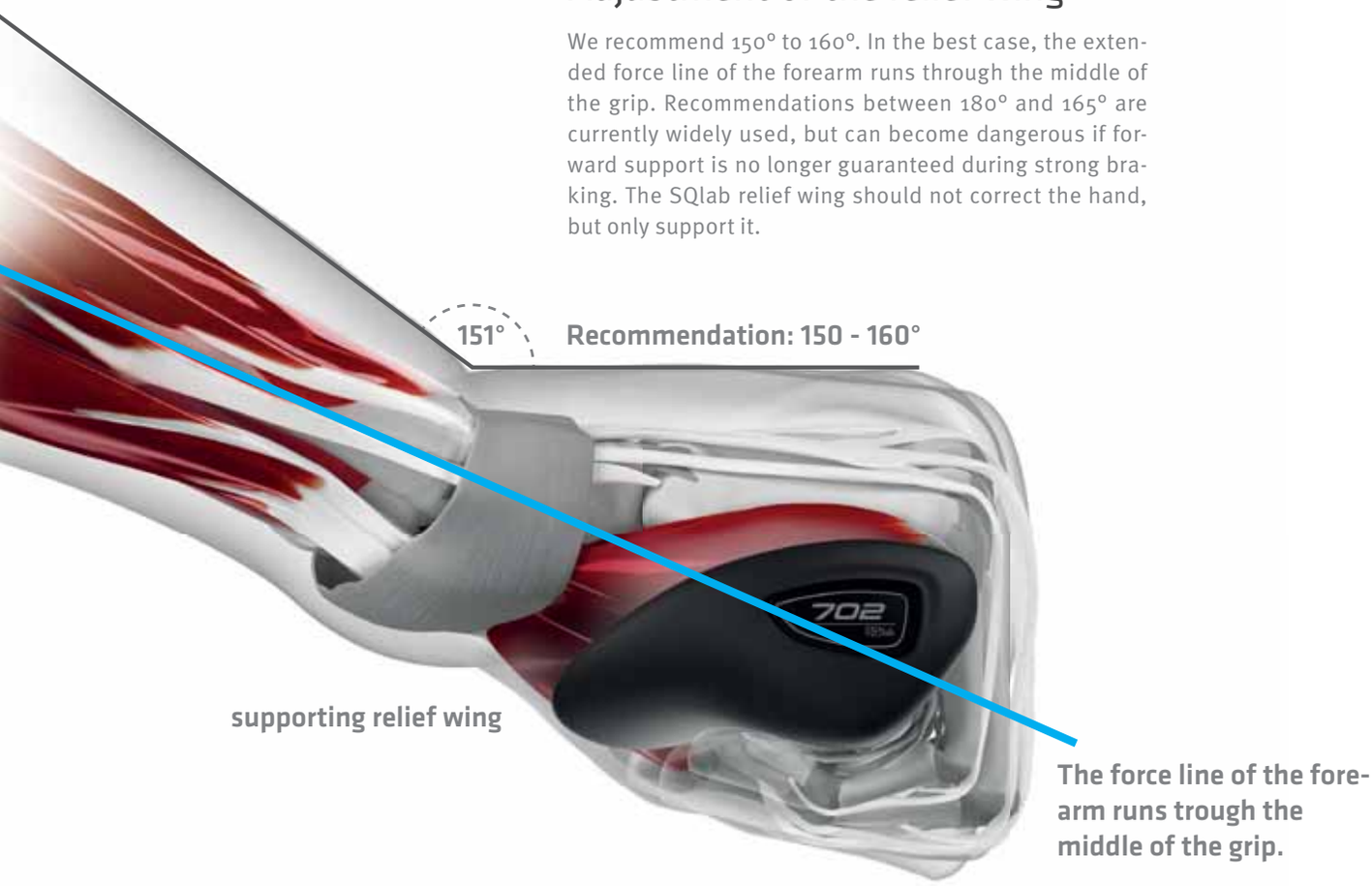
SQlab Solution

Relief wing
placed as far outside as possible for safe gripping.


710
SQlab

Adjustment of the relief wing

We recommend 150° to 160°. In the best case, the extended force line of the forearm runs through the middle of the grip. Recommendations between 180° and 165° are currently widely used, but can become dangerous if forward support is no longer guaranteed during strong braking. The SQlab relief wing should not correct the hand, but only support it.



Angular and extensive

Handlebars are round and because it is simple, grips are also mostly round. But the fingers are anything but round. They slip easily on something round and, in contrast to a flat table edge, do not find any support.

round = no grip

2. Cause

Wrong grip form.
A round grip offers only limited grip.

angular & extensive = perfect grip

SQlab Solution

Angular shape.
The slight angular shape of all our grips corresponds to the natural shape of the angled fingers and offers additional support.

Innerbarends®

Comfortable. Aerodynamic. Inside.

Perfect muscle relief

The perfect solution for relieving the muscle groups in arms, shoulders and back by changing the arm position on the bike, especially over long distances.

Maximum Speed

The aerodynamic, relaxed elbow position ensures maximum speed.

Natural Hand Position

SQlab Innerbarends® ensure an absolutely natural hand position.

Small and light

Innerbarends® weigh only 108 g per pair.

SQlab study on wind resistance

An internal study by SQlab on the bike track has shown that test riders with Innerbarends® could cover the same distance in the same time with 14 watts less.

10 laps were driven on the track with a constant speed of 36 km/h.

Two power meters provided by SRM were used to accurately record the wattage values. On average, the riders without Innerbarends® had to apply 293 watts, and the riders with Innerbarends® only 279 watts.

Barends mounted inside the grips have been available from SQlab since 2007.

Foot

The anatomy of the foot

The foot skeleton consists of a total of 28 bones. The foot bones are divided into tarsal bones, metatarsal bones and toe joints.

20 muscles, more than 114 tendons and ligaments provide the necessary mobility and stability of the bones to each other.

The arch of the foot

The foot has a longitudinal arch and a transverse arch. The arch of the foot is tightened by the muscles and held upright by the ligaments.

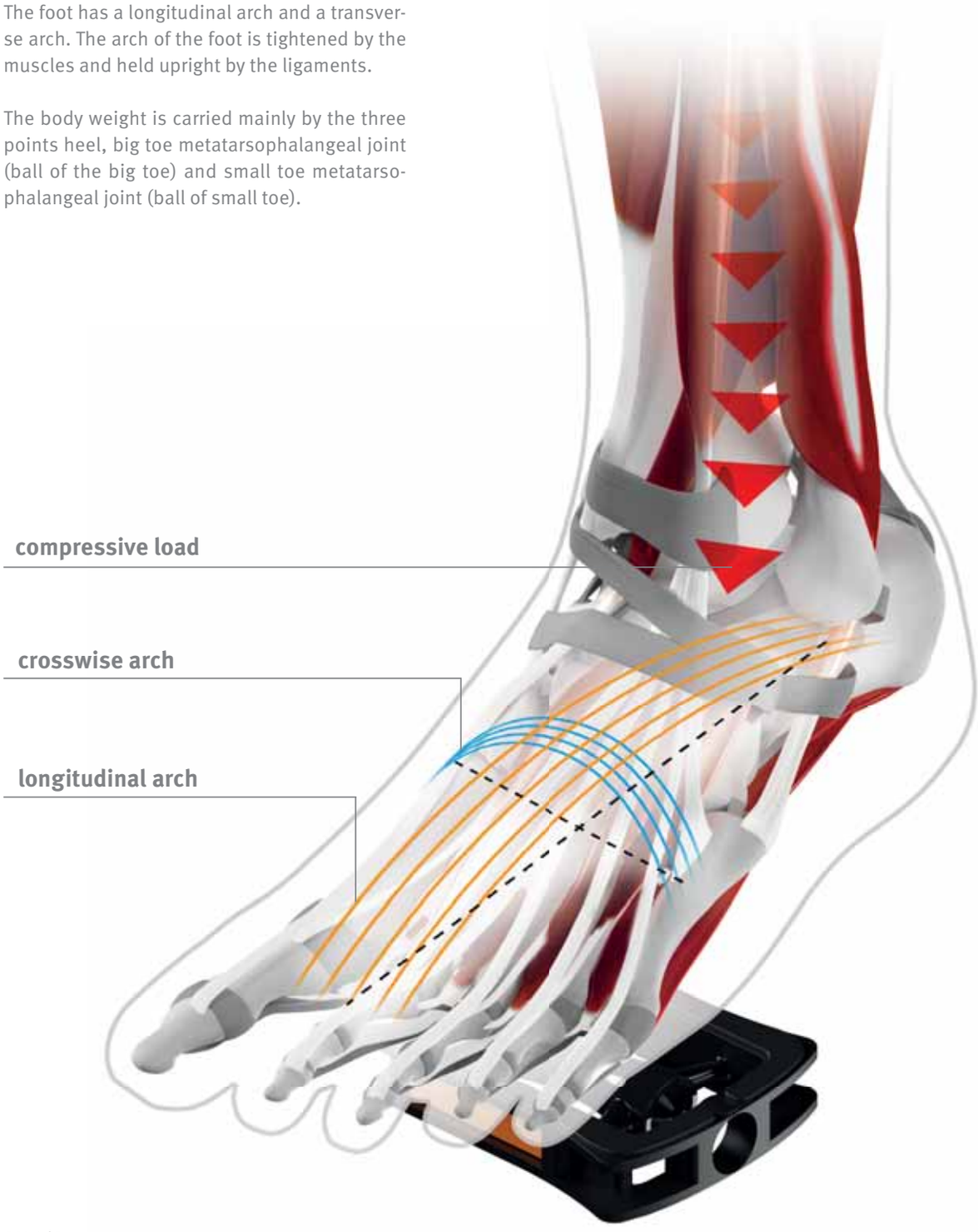
The body weight is carried mainly by the three points heel, big toe metatarsophalangeal joint (ball of the big toe) and small toe metatarsophalangeal joint (ball of small toe).

Biomechanics while cycling

Since there are no forces when cycling as when walking, the foot's damping function can be dispensed.

By lowering the arch of the foot, the foot itself becomes tired and above all the direct force on the pedal is reduced.

The excessive movement of the foot in the cycling shoe can lead to nerve or vascular constrictions, which manifest themselves in tingling sensations or numbness.



Foot Type Measurement

Footprint

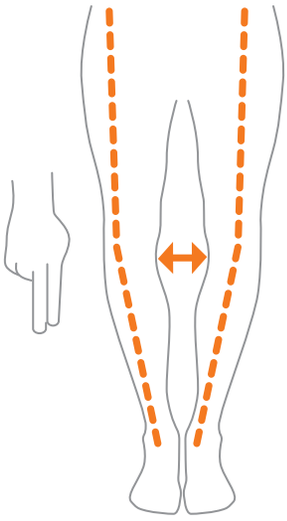
High Arch
A

Medium Arch
B

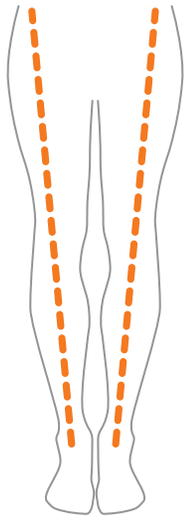
Low Arch
C

Flat Arch
D

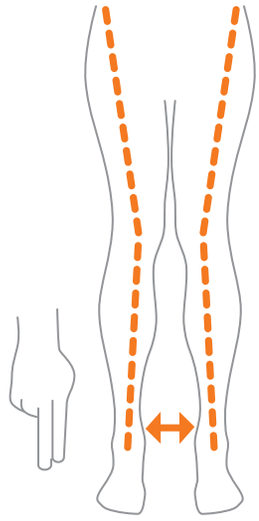
Leg Axis



Bow Leg
1



Straight Leg
2



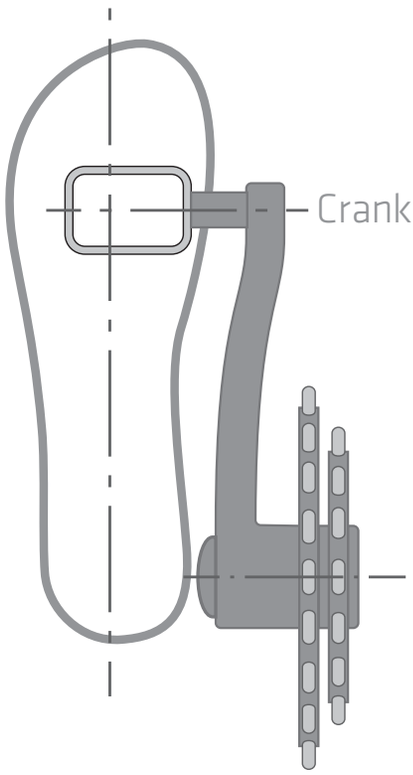
Knock Knees
3

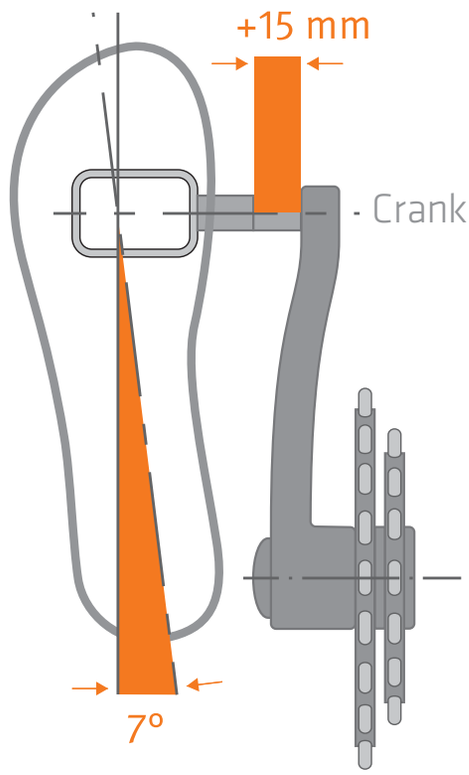
Your Result

A1, A2, B1, B2	A3, B3, C1, C2, D1	C3, D2, D3
Supination → Neutral	Neutral → Overpronation	Overpronation

SQlab gel plate for foot type determination at the SQlab dealer.

Pain and Numbness





Cause

One-sided load.
Pedals with a short axis force the feet into a nearly parallel position.

SQlab Solution

Pedals
with different axis lengths for a natural foot position.

What is your natural foot position?

Usually slightly V-shaped - the heels point inwards, the toes outwards.

The bike should adapt to this foot position. This is usually only possible with longer pedal axles. More freedom for the heels and no polished cranks.

Already from shoe size 43 and normal shoes it becomes scarce with most bicycles. 80% of cyclists need an XL axle length for a natural foot position, such as our Citypedal 521.

Feet are made to walk on. They must be flexible over the longitudinal arch. When cycling, the foot stands on the pedal and transfers the force efficiently.
Our Premium Partner dealers determine foot type and leg axis. The optimal fitting insole blocks the foot's own spring travel.

The power transmission improves and the comfort increases. The knee guidance improves and the knee joints are protected. Especially people with healthy feet and intact arch of the foot feel a clear improvement immediately.

The foot is the most important contact point and generates the drive.

Bicycle adjustment - basic rules

A subject that can fill several books. The following are very simple basic rules that everyone can apply themselves. We recommend the consultation and measurement in the specialized trade or with special Bikefitting experts.

On www.sq-lab.com under "Dealer search" you will find the best SQlab dealers as well as the best bikefitters recommended by us.

1. Saddle Height

Heel on the pedal. Pelvis straight, knee slightly bent

2. Saddle Offset

The knee perpendicular runs through the knee joint and the pedal axle. Usually you have to push the saddle a little forward.

Attention: The knee perpendicular on the kneecap means, that you sit approx. 3 cm further back. Pain in Knee and lumbar vertebrae can result.

3. Foot Position

The pedal axle should be at the level between the metatarsophalangeal joint of the big toe and the metatarsophalangeal joint of the small toe.

If the foot is positioned towards the metatarsophalangeal joint of the big toe, i.e. far back on the pedal, the lever becomes larger and the Achilles tendon can be irritated.

If the foot is further forward, no negative effects are to be expected. The trend is towards: foot further forward.

4. Foot Angle

The bike should adapt to the cyclist - see pedals.

5. Foot inside - outside

Also called Q factor. The further inside, the less the lever load is shifted to the inner bearing. If the Q-factor is higher, the pedalling movement is more similar to ice- skating. You step outwards.

The width of the pelvis determines the individual Q-factor. Biomechanically this is rather harmless.

6. V-wedge

There are V-wedges that lift the foot on the inside. The foot angles can be measured between 1.5° and 4.5° degrees and wedges can be useful in some cases.

Some require an elevation on the outside, some on the inside. When riding sport, the twisting of the bottom bracket usually means a V-wedge of a few degrees.

7. Handlebar height - inclination of the back.

The optimal, most comfortable and most relaxed back inclination is first determined by the pelvis.The pelvis is the central point. This is why the bike adjustment begins and ends with the saddle height.Saddle and handlebar at the same height is a good basic setting. The pelvis usually lies completely on the ischial branches of the saddle. The upper body is bent moderately forward. The posture feels good, relaxed and loose.Handlebars that are deeper than the saddle improve aerodynamics, but can lead to problems with the cervical vertebrae.

8. Distance handlebar – saddle

Many comfort bikes have a very short distance. The sitting position is stocky, the body tension loses itself, the back becomes round. The intervertebral discs, especially the cervical vertebrae and the lumbar vertebrae, are subjected to greater strain. The sitting position is therefore very upright.

Contrary to popular belief, this is usually not good for the back.

A greater distance (reach) brings the back into its natural S-shape and under a slight tension. Shocks can be better absorbed.

9. Handlebar Curve

Important rule: The transition from forearm to hand must be straight. MTBs with a moderate to aggressive sitting position and a handlebar width from 720 mm require a handlebar with at least 12° - 16° backsweep.

Handlebars between 6° and 9° are often fitted as standard.

For trekking and city bikes, the handlebar ends should be straight or even better, point slightly downwards. This relaxes the neck muscles.

10. Saddle Height

At the very end of the adjustments, but also during the tour, the saddle height should be checked again. Often the saddle post slips down almost imperceptibly and the saddle height decreases.

For technical MTB rides the saddle height can be slightly lower. We recommend an adjustable seat post for the MTB.

These are only rough recommendations - listen to your body. If you still feel pain or numbness after following the tips, change the settings or change the size or product.

Q [kju:]

a SQlab Sports Ergonomics Project

At SQlab we have been developing ergonomics for sports since 2002.
We solve problems and help to increase performance. Now also in sleep.
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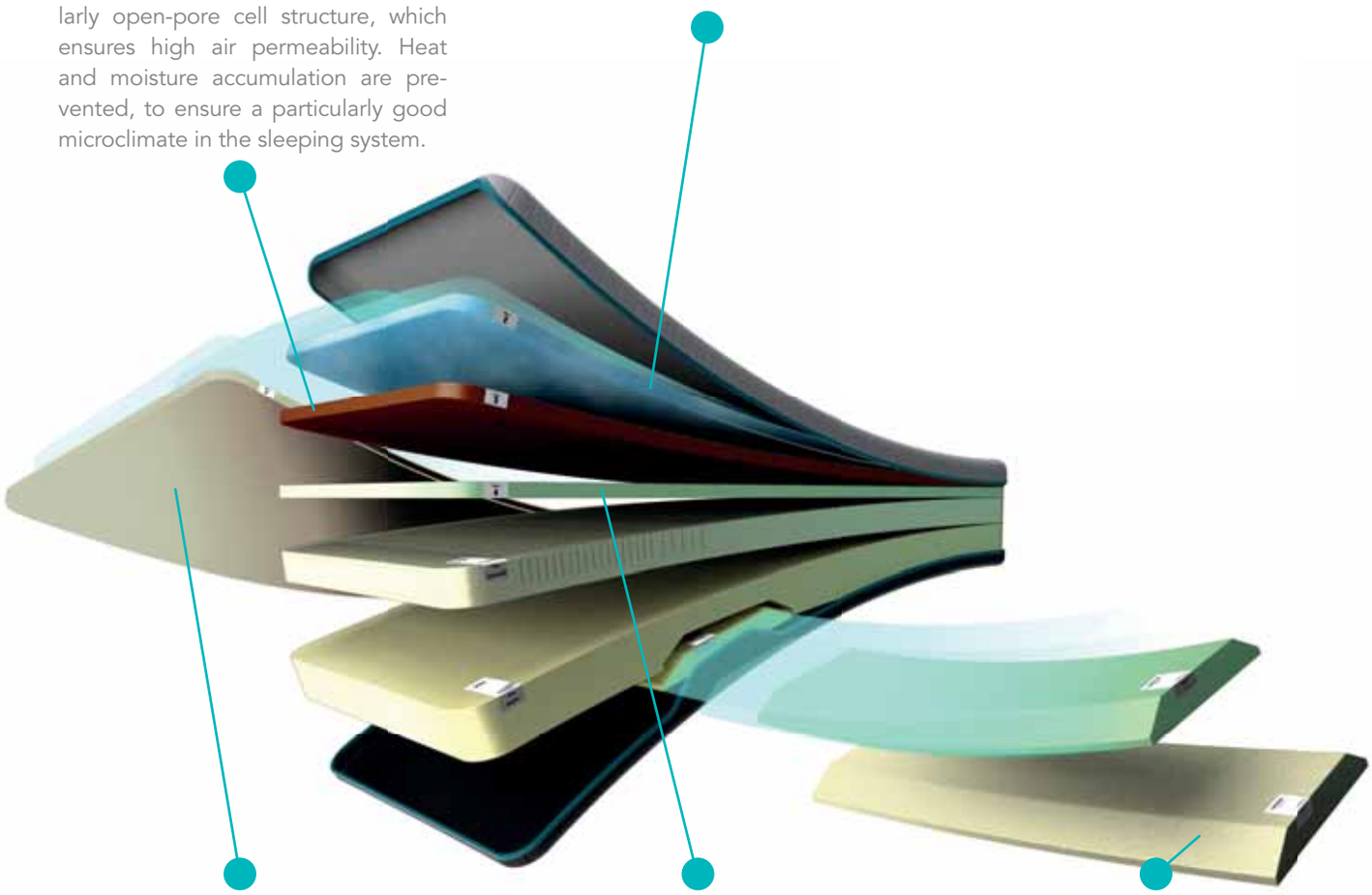

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