PERFORMANCE CYCLING CONDITIONING

A Newsletter Dedicated to Improving Cyclists

Volume 16, Number 7

WHAT'S INSIDE?

New Considerations in Exercise Techniques

For strength coaches, prescribing exercises has centered on the goal of increasing sports–specific strength/power and/or preventing injury using proper exercise techniques. However, the question is do these prescribed exercises contribute to long-term injury potential of the athletes through improper alignment and asymmetry?

Readers of this newsletter have been introduced to the concepts of Ron Huska's teaching from the Postural Restoration Institute. Now, Mike Arthur, strength and conditioning coach at the University of Nebraska for all sports other than football, has developed ten considerations that are applications of the Postural Restoration Principles as they apply to strength training methodology in the weight room. Considerations 1-5 deal with alignment as viewed from the side of the athlete. Number 6 deals with symmetry as viewed from the front of the athlete and the unnatural tendency of the body shifting to the left. Considerations 7-10 address the upper body as they relate to Considerations 1 thru 6. The basic goal of these 10 considerations is to maintain a neutral posture and to do strength training exercises that support this concept rather than promote bad posture/alignment.

Here's a taste of what readers will be introduced to in the coming months on this new concept. One consideration is not overstretching the hamstrings. The overstretch position of this stretch by bending forward at the waist with knees locked, touching the fingertips or even hands on the floor, is what most people think of as a "normal" hamstring stretch. What really is happening is hip/back flexibility development along with the hamstrings. This overstretch actually weakens the hamstrings thus hindering one's ability to hold the pelvis in a neutral position, which is necessary for proper alignment. If the hamstrings are weakened, the quads will become stronger thus creating a muscle imbalance. The result is over development of the quads in relationship to the hamstrings in the forward (anterior) tilt of the pelvis.

We are excited to be presenting this information in what I consider an "out-of-the-box" way of looking at what exercises one prescribes and how to do them. One thing for sure, it will give you something to think about.

Ken Kontor, Publisher,
Performance Conditioning Inc.

When it comes to cycling performance does pedaling technique really matter?

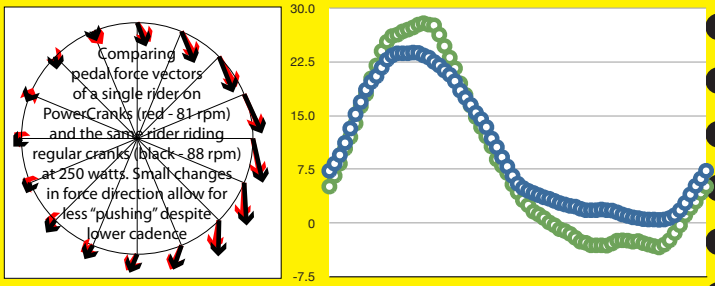
Of course it does. To say otherwise is like saying that cycling is the only sport in the world where the technique of the major component of the sport doesn't matter. But this myth persists. It persists simply because pedaling technique has been almost impossible to measure (requiring expensive pressure plate pedals generally available only in university research labs) and pedaling technique is almost impossible to change making it "impossible" to study. ***If something is hard to measure and even harder to change it is easy to conclude it doesn't matter.***

So, what is the optimum pedaling technique?

Now, there may be many different techniques possible and no one knows for sure exactly what is optimum but the one technique that many coaches talk about as being "optimum" is "pedaling in circles". But, what does "pedaling in circles" mean? It does not mean applying equal pressure around the entire circle, as is thought by many, as equal pressure around the circle is impossible because of the effects of gravity. What "pedaling in circles" really means is spreading the work out around more of the circle and doing no negative work on the upstroke — increasing the power at the top and bottom of the stroke and minimizing or eliminating the losses on the upstroke. Such a technique is exactly the technique Lance Armstrong has been trying to perfect since 1993, see: www.powercranks.com/Lance.html. There is now a tool (PowerCranks, Walnut Creek, CA - www.powercranks.com) that can teach this technique to your clients so you can concentrate on other things. Not a gimmick, a serious training tool actually used by the last three Olympic road race champions and many other Olympic, World, and National champions in a wide variety of cycling disciplines including track, cyclocross, mountain biking, and triathlon. You may not have heard about this use as it is a training tool and easily kept from others. Why would an athlete want to share an advantage with the competition?

What are the advantages of pedaling using this "full circle" pedaling technique?

1. It uses more muscle mass, increasing peak power potential.
2. It distributes the work around more of the pedal circle which means using more muscles, allowing any one muscle to be further away from its lactic threshold for any given power.
3. These changes together have the potential to greatly improve both pedaling efficiency[1], VO_2max[2] and sustainable power. Many studies support this approach.[3]



See the diagrams comparing actual pedaling forces changes seen in a single rider between regular cranks and PowerCranks. It is clear these are relatively small and subtle changes but these small changes in the direction of the applied force results in large changes in the resultant power to the wheel for any given muscular effort. **Note that when on PowerCranks the negative forces are completely eliminated and the forces across the top and bottom of the stroke are substantially larger over regular cranks. With these changes this rider is actually "pushing" less hard to generate the same power despite the fact he is riding at a lower cadence.** Can there be any doubt that as the rider changes their natural way of pedaling to this more efficient and powerful technique that performance will improve?

In the past (before PowerCranks) coaches and riders didn't have to worry too much about pedaling technique because it was pretty much impossible to know how a rider was actually pedaling (you needed pressure plate pedals, only available in the research lab) and, even if you got that information there were not any good tools to effectively change pedaling technique. Ignorance was bliss. But, this is about to change with the soon-to-be-released Metrigear Vector pedal (see: www.metrigear.com/products/). Soon, pedal force data will be affordable and available to everyone and your clients are going to be asking you for advice as to how to improve this aspect of their game. Better start planning how you are going to approach this now. Such changes do not come easily. You can set your clients on the 17 year path taken by Lance Armstrong or you can set them on the 6-9 month path allowed by integrating PowerCranks into their training. What are you going to choose? There is simply no more effective way than PowerCranks to effect this change.

In the near future, if you ignore this aspect of the cycling game we predict you will be seen by your ex-clients as "old fashioned" and "irrelevant". Prepare now. PowerCranks will help you teach this skill to your clients with maximum efficiency and if you become an associate, we can even help out your bottom line. Check us out,

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[1, 2, 3] studies that show cycling efficiency improvement, VO_2max improvement in trained cyclists, and many other studies related to pedaling technique (including those studies that many say "prove" that pedaling technique doesn't matter) are available here: www.powercranks.com/studies.html

PERFORMANCE CYCLING CONDITIONING

A Newsletter Dedicated to Improving Cyclists

Volume 16, Number 7

Medicine of Cycling: Hip and Knee Pain in Cyclists

Claudette M. Lajam, M.D., Assistant Professor of Orthopedic Surgery, NYU Hospital For Joint Diseases

Dr. Claudette Lajam is an avid cyclist and athlete. She is a team physician for USA Cycling. She served on the Board of Directors of the New York Cycle Club and is a major sponsor of an amateur cycling race team. She cares for recreational and elite cyclists as well as endurance and other athletes.

Dr. Lajam is a Board Certified Orthopedic Surgeon with special interest in joint replacement, revision joint replacement, and sports medicine/arthroscopy. She performs total knee replacement, total hip replacement, arthroscopic ACL reconstruction and arthroscopic rotator cuff repair for the shoulder. Dr. Lajam is a host on The Orthopedic Show for SIRIUS/XM Doctor Radio. You can listen to her on Monday evenings from 6-8 pm, EST on SIRUS 114 or XM 119.

Claudette M. Lajam, MD.

BGN INT XTP MSR MTB

Knee pain is the most common lower extremity problem in cyclists. It can result in decreased participation, enjoyment and performance. Hip dysfunction can also cause significant pain and detriment to performance and enjoyment. While it is impossible to cover all types of pathology in this article, we will address the more common sources of pain.

A vexing challenge in treatment of lower extremity pain is to identify the pain generator, or "PG." Pain can be caused by systemic disease, lumbar spine issues, hip pathology, knee pathology, neurologic conditions and vascular conditions. It is important to seek out a physician who understands cycling and the unique stresses placed on the body when riding. It is also imperative that each cyclist have a primary physician who can monitor general health and who can provide pre-participation evaluation before periods intense training or competition.

Knee Pain

The knee takes on tremendous stress during cycling. With average cadence of 80 rpm, the knee performs thousands of repetitions of the singular pedaling motion. Most stress is undertaken in the patellofemoral compartment (the area under the kneecap). Injury to this area can result in pain and decreased performance.

Remember that any inflammatory condition within the knee joint can cause a part of the quadriceps muscle to shut down, thus magnifying any muscle imbalances that have already occurred. It is important to heed warnings of pain and swelling in the knee with early treatment so that the problem does not become worse! Also, know that the PG for knee pain can be the hip or the lumbar spine. If pain in the knee is vague or seems to shoot into the groin or the back and does not go away with treatment, evaluation of the hip and spine is recommended.

1. <u>Chondromalacia of the patella</u>: Chondromalacia means "bad cartilage." It is characterized by changes in the joint surface cartilage on the undersurface of the patella, on the groove that the patella rides in, or in both areas. These changes can come from trauma, can be age-related or can occur because of natural alignment of the joint.

Symbols to Success
Articles preceded by

BGN indicates author believes content is for beginning-level athletes with training age of 0 to 2 years.

INT indicates author believes content is for sport (intermediate)-level athletes with training age of 2 to 4 years.

XTP indicates author believes content is for expert-level athletes with training age of over 4 years.

MSR indicates author believes content is for master-level athletes over 30 years of age.

MTB indicates author believes content is for mountain biking.

NOTE: Training age year is continuous year-round conditioning.

R following articles indicates the content has been reviewed by the editorial board.

O following articles indicates the content is the sole opinion of the author.

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a. Symptoms: pain behind the kneecap, swelling, catching (the knee gets stuck in the extended position and needs to be wiggled to bend). Pain precipitated by hilly rides, riding in bigger gears or at slow cadence. Pain also with stair-climbing or descent, squatting or deep knee bends.

b. Diagnosis: the doctor will examine the knee for alignment ("Valgus" knees are more likely to have this condition), motion and telltale signs of the condition. Xrays are taken to view the joint spaces and to exclude fractures. Cycling history to determine bike fit, riding habits and injury history can help with diagnosis.

c. Treatment: A period of lower resistance training (high cadence and flat terrain) along with anti-inflammatory medication, icing and muscle balancing exercises – including strengthening quadriceps and stretching IT Band, hamstring and calf muscles – is usually helpful. Cleat and saddle position should be checked to rule out fit issues. If the problem is purely anatomic, sometimes realignment surgery is an option.

2. Patellar tendonitis: Inflammation of the tendon between the kneecap and the shin bone can be very painful and tough to treat.

a. Symptoms: Pain when pedaling or extending the knee against resistance. Location is in the tendon and soft tissue just below the tip of the kneecap. There may be swelling of the tendon and tenderness to the touch.

b. Diagnosis: Physical examination shows swelling and tenderness in these locations. Xrays are usually negative. MRI will show inflammation of the tendon and the absence of other pathology.

c. Treatment: Bike fit is very important. Cleat and saddle position should be checked to see if too much lateral stress is being placed on the tendon. Training modification to flat terrain and low resistance riding is recommended until pain-free. Focused icing and NSAID medication is helpful to reduce inflammation. Formal physiotherapy can assist. Injections with steroids are NOT recommended. This condition is very frustrating and may take a long time to treat.

3. Meniscal or ligamentous tears: Internal pathology of the joint can occur in all age groups. In younger athletes, twisting injury or trauma is usually involved. In older patients, degenerative meniscal tears can cause irritation within the joint and start a cascade of events that can affect performance.

a. Symptoms: Meniscal tears can cause swelling, locking in a flexed position and catching of the knee. Pain is usually on the inside or the outside of the knee. Ligament tears cause instability and difficulty doing cutting or twisting motions.

b. Diagnosis: Physical examination alone can give a lot of information. Xrays to rule out fractures or arthritis are performed. If conservative treatment fails or if ligament tears are suspected, an MRI may be ordered to see the soft tissues.

c. Treatment: Most meniscal tears in older people can be treated non-surgically. If this fails and MRI shows significant tears, arthroscopic surgery can be helpful. Ligament tears are treated according to the particular needs of the patient. Many cyclists who are older elect not to have ACL reconstruction, as cycling does not involve cutting and twisting. Younger patients will usually elect to have ACL reconstruction so as to decrease instability and perhaps delay onset of arthritis in the joint.

4. Iliotibial band syndrome: results from friction of the expansion of the Iliotibial band (ITB) on the outside of the femur bone during repetitive motion. The band moves from anterior to posterior during pedal motion. When inflamed, it can cause severe pain on the outside of the knee.

a. Symptoms: Pain on the outside of the knee, often stabbing or burning, that occurs in concert with the pedal stroke. There may also be pain at the outside flare of the hip and down the lateral thigh to the outside of the shin bone. Pain goes away with rest early on, but with increasing severity there is pain all the time.

b. Diagnosis: physical examination is the key. Tenderness, positive Ober test for tightness of the ITB and sometimes even snapping of the band along the condyle. MRI has limited utility here, but is performed sometimes to rule out other confounding conditions.

c. Treatment: nonsurgical treatment is useful in most cases. Bike fit should be examined, particularly cleat positioned too internally rotated or too forward on the shoe. Cleats with too little float can also exacerbate this condition. Focused stretching, cross-fiber ice massage, rest and NSAID are helpful. Foam roller stretching of the ITB can help prevent the condition from returning. Surgery to release the posterior fibers of the band can be performed in the most stubborn cases.

5. Plica syndrome: The normal knee is enclosed in a capsule of tissue. When this capsule becomes inflamed, sometimes folds or shelves of the capsule become a mechanical source of pain in the knee. These folds are called "plica," which means "fold."

a. Symptoms: Pain, swelling and mechanical clicking, usually on the inside of the knee. Pain is brought on by motion and improves at rest.

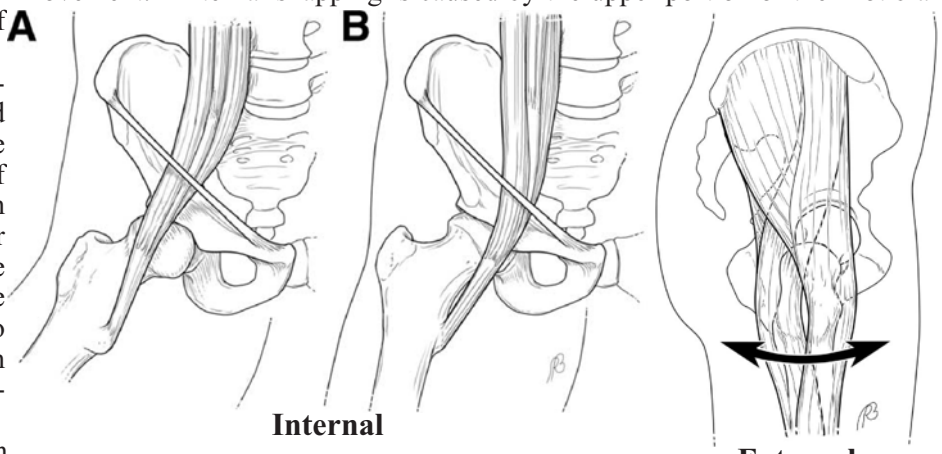
b. Diagnosis: Physical examination is important, since on MRI the plica may appear as normal capsule.

c. Treatment: Elimination of inflammation is the key to treatment. NSAID medication, focused icing and training modification to exclude painful activity are the best treatment. Surgical treatment with arthroscopy can remove persistent plica.

Hip Pain

The hip is increasingly recognized as a source of pain in athletes. Improvements in understanding of the joint, along with advances in technology have allowed better surgical treatment of early problems. Again, the PG for hip pain may be a lumbar spine condition. If hip pain is unexplained by thorough evaluation, a lumbar spine evaluation is recommended.

1. Snapping hip syndrome: When snapping is painless it does not require treatment. For painful snapping, there are two types: Internal and External. Internal snapping is caused by the iliopsoas tendon's sliding over the front of the femur during movement of the hip, particularly during a "frog kick" type of movement. External snapping is caused by the upper portion of the Iliotibial band when it passes over the greater trochanter of the femur.



- **a. Symptoms:** For internal, the athlete may have deep groin pain and will experience a snap when the hip is moved in a frog kick type of motion. The snap sometimes can be heard across the room. For external, the athlete may believe that the hip is "dislocating." The outer edge of the hip can be seen to push out during motion and then come back in. Pain is over the outside of the hip.
- **b. Diagnosis:** Internal snapping can be tough to diagnose. Physical examination is the key, along with imaging studies to rule out other issues. Bursography, which involves the injection of contrast into the bursa, can be of value in certain cases. External snapping is also diagnosed with physical examination and imaging to rule out other causes if necessary. It is very important to establish an accurate diagnosis before undergoing any surgery.
- **c. Treatment:** For internal snapping, an intensive stretching program focused on the lower back and hip is recommended. NSAID treatment and modification of training to exclude painful activities is important until pain is gone. Core strengthening can be helpful. For external snapping, modification of training and treatment of inflammation are key. Strengthening of abductors and the foam roller may be helpful in decreasing snapping. Surgical treatment for persistent internal snapping involves release of part of the tendon from the lesser trochanter of the hip. This can now be performed arthroscopically, but only after other measures have failed.

2. Impingement Syndrome: Abutment of the bones in the hip can cause pain and dysfunction. When the cycling pedal stroke causes this event, pain and limitation of performance can occur.

- **a. Symptoms:** Persistent pain in the groin area, brought on by flexion and usually internal rotation of the hip.
- **b. Diagnosis:** Physical examination and plain X-rays to rule out other issues are important first steps. MRI is helpful if an associated soft tissue lesion is suspected. Diagnosis is tricky as there are many PGs within the hip joint.
- **c. Treatment:** Modification of activity, a stretching program and anti-inflammatory medication can be helpful. Bike fit should be assessed to ensure there is no excessive hip flexion during pedal stroke. When pain is persistent, surgical treatment with arthroscopy and removal of the impinging part of the bone can be performed. Recovery from surgery takes 6-12 weeks, depending on the procedures performed.

3. Labral tears: The soft tissue rim around the hip socket is called the labrum. When tears occur, the loose piece may flip in and out of the joint and cause inflammation and pain. Tears are also thought to cause loss of the suction effect of the joint, thus creating micro-instability.

- **a. Symptoms:** Groin pain with motion, especially when the hip is brought into flexion. The athlete may feel a click or catch inside the hip. The athlete can sometimes remember a traumatic event after which the pain began.
- **b. Diagnosis:** Can be difficult, but combination of physical examination, x-rays and MRI with contrast can show the lesion.
- **c. Treatment:** Early treatment includes training modification, stretching and NSAID medication. If this fails and a labral tear is seen, the athlete may elect for surgical treatment with arthroscopic repair or debridement. If surgery is performed, it is important that the surgeon address any bony impingement. Recovery from surgery is 6-12 weeks.

4. Arthritis: When the bearing surface cartilage wears away, athletes may feel pain and stiffness in the hip.

- **a. Symptoms:** Pain and stiffness in the groin and hip. Pain occurs with weight bearing. The athlete may limp on the affected side. Cycling might not be painful, even with severe disease.
- **b. Diagnosis:** Plain x-rays along with history and physical examination will show arthritis in the hip. MRI is generally not needed if x-rays show the condition.
- **c. Treatment:** Conservative treatment includes NSAID medication, stretching and core strengthening. Cycling can continue so long as the athlete can tolerate it. Fit may need to be adjusted so that the stiffness in the hip does not affect the other joints and the low back. This can be done by raising the handlebar position to more upright. Arthroplasty hip surgery is the only reliable surgical treatment. Hip resurfacing or replacement may be performed depending on the severity.

5. Fractures: Traumatic fractures of the hip can occur after crashes or trauma. These are fairly obvious and should be treated immediately. However, stress fractures of the femoral neck can occur over time and are more difficult to diagnose. Catastrophic consequences may occur if a stress fracture becomes a complete fracture in a young person. Many cyclists have low bone mineral den-

sity from lack of weight bearing activity and are at risk.

a. Symptoms: Groin pain, mostly with weight bearing activity and sometimes at rest. Pain may be vague. This condition may also present as vague anterior knee pain or thigh pain.

b. Diagnosis: Evaluation and plain x-rays may not show the fracture. If pain is persistent and not explained by examination, MRI should be performed to rule out stress fracture.

c. Treatment: Depending on location of the fracture, surgery may be indicated to place screws across the area so as to prevent completion of the fracture. Some types of fractures can be treated conservatively with protected weight bearing and modification of activity. If stress fractures are seen in young athletes, assessment of bone mineral density and evaluation by a general doctor is recommended to rule out other conditions.

Conclusions

Lower extremity pain is common in cyclists, but many conditions can be treated conservatively. It is important to recognize these issues and treat them early so that they do not affect performance long-term. Bike fit is critical in prevention and minimization of lower extremity pain. Most athletes can continue cycling at low intensity during treatment and recovery from injury. O

Chain Links: Clink **HERE** to link the article Cycling Knee Pain Prevention by Bernard Condevaux to learn more.
http://www.medicineofcycling.com
http://twitter.com/medofcycling
Find us on Facebook

METHYLHEXANEAMINE AND DIETARY SUPPLEMENTS

Beware - Your Supplement Could Cause a Positive Test

Kelli Feltmann, USADA Education Manager

BGN INT XTP MSR MTB

This advisory comes after multiple announcements that athletes around the world have tested positive for methylhexaneamine, a prohibited stimulant. Methylhexaneamine is known by many names including 1,3-dimethylamylamine (DMAA), dimethylpentylamine (DMP) 4-methylhexan-2-amine, Geranamine, and geranium oil, extract, or stems and leaves. Many products sold as dietary supplements openly list this substance on their labels, such as Jack3d (USP Labs), Lipo-6-Black and Hemo-Rage Black (Nutrex), Spriodex (Gaspari Nutrition), F-10 (Advanced Genetics), Clear Shot (E-Pharm), 1.M.R. (BPI Sports) and many others.

Kelli Feltmann

While it is not known whether the above products actually contain methylhexaneamine, athletes should steer clear of products that advertise to contain these substances.

Also, if "geranium" is listed as an ingredient on the label of a supplement, be advised that the product may contain synthetic methylhexaneamine. We have also seen instances where a supplement actually contained ingredients that were not listed on the label. In some cases, these non-labeled substances may trigger a positive test.

Athletes are also advised to exercise good judgment and avoid products with suspicious and exaggerated claims or names, which include marketing performance terms such as "stacked," "muscle," "mass," "tren," "bol," "anabolic" or "legal steroid," "power," "blast," "energy," "stimulant" and similar terms. The product may in fact be a designer steroid or contain a prohibited substance, such as the prohibited stimulant methylhexaneamine.

The ongoing problem of dietary supplement mislabeling continues to create a risky environment for athletes. Unfortunately, due to the current permissive regulations governing the supplement industry, USADA cannot give guarantees to athletes regarding which products are safe and free from contamination.

Athletes need to be aware that they assume the risks of adverse health outcomes and positive anti-doping tests when choosing to take supplements. Athletes are urged to take necessary steps to be informed consumers and evaluate any supplements, including: understanding all ingredients, consulting with a physician to assess whether taking a supplement is necessary, and having products tested to ensure safety. Please remember that strict liability applies at all times, and an athlete is responsible for any prohibited substance found in their system.

USADA continues to work with our partners at Supplement Safety Now, which is a public initiative, to protect Americans whose health is threatened by the consumption of dangerous over-the-counter products disguised as "healthy" supplements. Go to **www.supplementsafetynow.com** and join the effort. R

Elite CYCLING Performance Digest

From Frazier Cycling: Issue and Questions in Youth Cycling Development #13

Overuse Injuries and Youth Cyclists

Ralph Frazier and Kelli Rogan- Frazier Cycling

Frazier Cycling's Atlanta-based Junior Development Program was developed by Ralph Frazier and Kelli Rogan. Ralph has over 35 years of cycling experience as an endurance and marathon racer and a coach. Kelli has 10 years experience of coaching juniors and masters as well as an impressive track and race racing career. Frazier Cycling has a mission to develop the next generation of cyclists with an appreciation for the sport, life-long physical fitness, sportsmanship, teamwork and commitment. As the southeast's largest junior development program, they have been recognized by USA Cycling News as "an excellent model for other junior development initiatives"...focusing on "character as much as athletic ability." The 2008 Frazier Cycling Juniors team holds 9 state championships and 9 national medals, including 2 national championship titles.

Ralph Frazier

Kelli Rogan

The publisher of this newsletter, Ken Kontor, suggested that we write a column concerning overuse injuries and young cyclists sighting a position paper published by the National Athletic Trainers Association (NATA). (see companion report accompanying this article). The paper was not specific to cycling, but "the concept of doing too much is an issue… With growing young kids this becomes even more important." As a result, Ken suggested that we may "want to address some aspect of this in coaching young cyclists."

The position paper, ***National Athletic Trainers' Association Position Statement: Prevention of Pediatric Overuse Injuries*** (April 2011), was very informative and particularly interesting because the purpose of the position paper is to provide certified athletic trainers, physicians, and other health care professionals with current best practice recommendations regarding the prevention of overuse injuries in athletes from the ages of 6–18 years. **Chain Link:** Click **HERE** for a summary article on the full report from the publisher.

According to the paper, overuse injuries for our youth "represent a significant health care concern." The paper points out that some reports and clinical observations indicate that half of those pediatric patients visiting sports medicine clinics are for chronic injuries. Furthermore, these injuries often result in several physician visits, recurring rehabilitation, and lost participation time in their sport.

The position paper is concentrated on pediatric overuse injuries for repetitive sport activities including pitching (baseball), tennis, running, soccer, basketball, volleyball, gymnastics, cheerleading, and ice skating. Cycling is not mentioned. This omission could be due to the relatively small number of young participants compared to those of other sports. Even so, cycling qualifies as a repetitive sport activity because of the highly repetitive action of pedaling. I

believe that the small number of participants is a factor in cycling not being included in the paper; however, it is my opinion that cycling does not present the skeletal and muscular strain inherent to the other cited sports and activities. Of course, I'm partial to cycling, but throughout our eight years of training junior cyclists, we have not observed any chronic "overuse" injuries due to cycling. The most closely associated aliment reported by our young cyclists is "achy knees". Primarily this aliment has been reported by some of our girls, ages 12 to 14, as they enter puberty. Each time this aliment has been reported, it has been quickly remedied by making adjustments to saddle height and/or saddle fore/aft position to accommodate their growth. Also, our team physical therapist has provided specific stretching exercises to expedite flexibility and recovery. These remedies have been very successful. In fact, none of the athletes who have experienced "achy knees" has developed any chronic impairments that have impacted their normal training routine. It is likely these aliments would become chronic without intervention. Additionally, perhaps we would have more reports of "achy knees" if we would not proactive by constantly monitoring saddle position for each junior athlete. Indeed, monitoring and adjusting saddle position could be considered a necessary "preventative measure".

The NATA position paper noted that certain athletic governing bodies and organizations have instituted sport changes to accommodate young athletes. The paper mentions USA Cycling's gear-ratio restriction for juniors, Australia's age-related regulations that include race distance limitations, and USA Swimming's recommendations for the number of sessions per week and the length of each session for various levels of competitive age-group swimming.

I found these sports changes interestingly familiar. Obviously, the gear-ratio restriction is familiar, but USA Swimming's approach is very similar to the approach that we use within our Frazier Cycling program levels for juniors. Originally, we discussed our program levels in our series **Creating and nurturing a Youth Cycling Pipeline – Youth Programming**. **Chain Link:** For the entire article click **HERE**.

As you look at the overview, keep in mind that each weekly training schedule is based on age, physical development, and competency/experience. The progression of program level corresponds with the progression of age, physical development, and competency/experience.

- Program Level 1 – minimal practices and rides for competitive training – typically ages 10 – 12
- Program Level 2 (training years 2 to 3) – practices and rides for serious competitive training – typically ages 13 – 14.
- Program Level 3 (training years > 3) – practices and rides for ultimate competitive training – veteran riders, ages 15 – 18

Here is an example our guideline table for the number of weekly training workouts for each Age Group and Program Level.

Age Group	Beginner	Weekly training workouts	Intermediate	Weekly training workouts	Advanced	Weekly training workouts
10-12	Level 1	2 – 3	Level 1 & 2	3 – 5	Level 2	4 – 6
13-14	Level 1 & 2	2 – 3	Level 2	4 – 6	Level 2 & 3	5 – 8
15-16	Level 1 & 2	2 – 3	Level 2 & 3	4 – 6	Level 2 & 3	6 – 9
17-18	Level 1 & 2	2 – 3	Level 2 & 3	4 – 6	Level 3	6 – 9

- Beginner: training years < 2
- Intermediate: training years, 2 to 3
- Advanced: training years > 3

Although we have not experienced chronic overuse injuries among our junior cyclists, I certainly agree with the position paper's conclusion which states "the major objective in managing repetitive or training injuries in athletes of any age should be to determine the risk factors for injury and identify steps to prevent the occurrence of these injuries." This emphasizes the importance of structuring your program's practices to address the different age groups. Remember, juniors are not little adults. ●

Got a Youth Development Question?

If there is a particular topic you'd like us to discuss or if you would like to share a junior coaching experience or ask a question, contact us at 770-513-8640 or **info@fraziercycling.com**. We will publish your requested information in the next issue as space allows.

CYCLING ROUNDTABLE: ASK THE EXPERTS
THE MENTAL SIDE OF CLIMBING

Kevin Lee Lippert, Steve Madden, Dirk Friel, Tom Ehrhard, Kristen Dieffenbach Ph.D.

USA Cycling Continuing Education Unit (CEU) #50

This program is designed to augment the clinics and seminars offered by USA Cycling and other organizations such as American College of Sports Medicine (ACSM) or National Strength and Conditioning Association (NSCA). Each test in Performance Conditioning for Cycling is eligible for 0.1 CEU in category. A maximum of 0.5 CEU from PCC self-tests can be accumulated in a calendar year toward re-certification.

Instructions: Read the article and choose the answer that best answers the question.

In order to receive .1 CEU you must answer 6 of 8 questions correctly. A candidate will be allowed one "retry" submitting answers a second time. You may pay for and take the online self test through your MYUSACYCLING function and pay $25 or send in a hard (or fax) copy with a payment of $25 (after 1-1-10). Each self-test is worth 0.1 CEU. To send in a hard (fax) copy of the self test and payment information to either 719.434.4224 or mail to:

Coaching Education Manager
USAC
210 USA Cycling Point Ste 100
Colorado Springs, CO 80919

BEG
INT
XTP
MSR
MTB

How do you coach your athletes to overcome the fear factor in climbing? What mental techniques such as teaching "mind games", mental imagery etc. do you advocate to overcome fear and become an effective climber?

A large part of being successful at climbing is the ability to mentally prepare for a climb, as well as, the ability to stay focused and relaxed while climbing. In both cases staying focused and relaxed is in large part learned through smart training.

Athletes tend to deal with impending high intensity situations much better if they have had a steady, moderate training program that develops not only their fitness, but also their mental confidence. Through training the athlete learns they only have control over themselves and if training has developed properly they have the tools to deal with any given situation in an effective manner.

Mental preparation for climbing can also be attained through effective visualization techniques. Positive mental focus can be a successful strategy to help an athlete lower anxiety levels, and increase arousal. Positive past experiences can be a very effective strategy to overcome fear and turn negative "mind games" into a focused state of being.

Tips to help built confidence:

End interval sessions with the ability to do "one more". This will not only end workouts on a positive note, but also allows for quicker recovery between high-intensity days. Steady, moderate improvement is better than quick gains.

Build each ability level before going on to the next. Climbing is not only the ability to maintain near, or above lactate threshold, but is also largely dependent upon solid aerobic conditioning, force, skills and muscular endurance. Too many skip these essential "lower intensity" abilities and go straight to anaerobic endurance.

Focus on a past successful climbing experience to help deter negative thoughts and increase confidence. This can be built upon even within a race. If previous climbs have been completed successfully, reassure yourself that future climbs can be successful too. **-Dirk Friel**

At some time, everyone has a fear of getting dropped or not performing up to their own self-induced standards when it comes to climbing. The main issue that consumes riders while climbing is the pain involved, worrying about not being able to tolerate this exercised induced pain for the amount of time that they must endure and the mental pressure to keep up with other riders that may have more natural talent in climbing or may just be better at that time because of their training program and training age. The self-induced mind games and self-bashing that riders place on themselves can be overwhelming at times. The way I try to get riders to overcome this, is by focusing in on the big picture (what time of the year it is, are they performing within their training age and development, and comparing where they are at within their own training periodization for their major goal for the year) and by looking at the whole picture objectively (did they ride against riders that are pure climbers and they are more of a heavily massed sprinter?). Everyone can become a better climber, however, riders have to be realistic when looking at what style of races suit their given abilities and how they can use what ever climbing ability and training development they have to maximize their race performance. I have seen way to many riders who can't climb at all, but race really well in flat races, mentally bash themselves when they want to win climbing races and don't. These riders don't look at the bigger picture and focus the majority their real efforts at participating in races that they can do well. Every one wants to have some accomplishment within a sport that they participate

in, and with that, one should look at what type of race they seem to do well in, try to do well in those types of races that suit their abilities, train in terrain and participate in races that suit "all" abilities so they can maximize their overall training development and keep the big picture in mind.**-Kevin Lee Lippert**

Climbing is unique because it has a unique physiological component. Riding on the flats has a very important aerodynamic aspect, which results in the athlete with the biggest ratio of cardiovascular endurance and power to aerodynamic efficiency to have a physiological advantage. Large athletes who have this power compete favorably because the aerodynamic difference between them and smaller athletes can be quite small compared to their size/power differential. In climbing, you have a different physiological challenge, because climbing is a function of cardiovascular endurance and power to WEIGHT. Weight differential becomes the key variable, and that is why the "2-1" rule still prevails in cycling--the best climbers generally have two pounds of body weight for every inch of height. A hypothetical 6 foot rider that weighs only 144 pounds (what any of us would label skinny) will generally beat a 6 foot rider weighing 170 pounds (with an identical VO_2Max) up a long climb.

This presents a huge dilemma for the American rider. Most of our races do not occur over terrain with true climbs. Therefore, bigger riders generally do well in American criteriums and time trials. When races do involve climbing, a different type of rider prevails. Although it sounds humorous, when watching a criterium, look for riders with big butts to win--when things go uphill, skinny butts win. The American rider can improve their climbing, therefore, by simply losing weight. Shed ten or twenty pounds, and you'll go uphill much, much faster.

Fear therefore affects riders in different ways when it comes to climbing. My skinny guys make other people fear them, whereas my bigger guys who eat skinny riders for lunch in the sprint see a looming climb as more of a wall than a challenge. However, even the good climbers have fear, because a bad day means that the other skinny guys will clobber you and before you know it, you're the one skinny butt in a group of more generously endowed glutes.

The one mental trick that helps riders focus during a climb is what I call mental drafting. Although the drafting effect rarely exists on a climb, sitting on another riders (hopefully a steady one) and letting them make all the decisions can provide a degree of mental quiet and efficiency that can help a rider overcome a bad spot. In the most extreme cases where the rider is on the edge of cardiovascular disaster, they can just stare at some part of the front rider's bike in an attempt to disassociate themselves from the pain. It is commonly said that good climbers know how to get into a rhythm--I disagree. Good RACING climbers know how to get the other riders OUT of their rhythm--they are active, not reactive. They usually let someone else make the first move, but then they counter-attack--and attack again and again. They want to control the tempo rather than being controlled by it. Some riders who aren't good climbers need to be as efficient as possible, and that's why the good climbers are often more active and change tempos often.

So, my advice is different for good climbers. They need to be aggressive and gain positive mental attitudes by controlling the tempo. Mediocre climbers, on the other hand, need to be as efficient as possible, maintaining a constant tempo and letting someone else set the pace while they "mentally draft."**-Tom Ehrhard Ph.D.**

I encourage my athletes to take an active role in understanding and mastering their climbing concerns. As a coach, I strive to provide them with as much help and guidance as possible, but ultimately the athlete needs to be able to overcome his or her own fears because even in a pack, climbing is a solo effort. When helping athletes cope with and overcome climbing fears, I first work with the athlete to understand what it is that he or she is actually worried about. Are all climbs an issue or is the athlete concerned about a particular wall or section of switchbacks? Is the athlete afraid of getting dropped, is she worried about letting her teammates down, is he anticipating the 'pain' of a hard climb, or is it a combination of things? Clearly identifying the athlete's climbing concerns provides the information needed to choose the proper techniques to effectively conquer or at least manage the concern.

When working with climbing concerns, it is also important to get a realistic picture of the athlete's abilities and to set goals accordingly. For a 'clydesdale' type Cat IV rider, a KOM might not be a realist goal. Focusing on such an unrealistic goal will further fuel his concerns and fears, making each climb seem more ominous. When properly used, goal setting is a very effective tool for providing focus and enhancing confidence. It is critical that the goals set are challenging yet realistic. I help my athletes develop goals that are realistic based on their current fitness level and abilities and that encourage them to stretch their limits. Thus, for my clydesdale rider, our initial goal might be to start climbs at least mid-pack and then if he slides back to maintain contact with the back of the pack throughout the climb. This goal provides the athlete with a challenge to focus on and a means to evaluate and improve his performance.

I avoid the use of terms such as 'mental games' because it gives athletes the impression that we are trying to create an illusion or trick to help them improve. Instead, I focus on the use of mental skills. Everyone has mental skill strengths and weaknesses, just like we all have physical skill strengths and weaknesses. And, just like the physical skills, our mental skills – weak and strong – need to be practiced routinely during training in order for them to be effective in competition. Further, it is important to understand that strong mental skills will help an athlete make the most of his or her abilities, but they can't replace the hard training or genetics gifts that make great climbers.

Two of the mental skills that I have found to be very successful in helping rider's improve their climbing abilities through enhanced focus and improved confidence are mental imagery and positive self talk. Until mastered, mental imagery should be practice off the bike, while self talk can be used both on and off the bike. Both skills should be used routinely for maximum effectiveness.

Mental imagery involves more than just seeing an image in your 'mind's eye'. Good mental imagery involves using all of your senses – sight, sound, touch, taste, and kinesthetic awareness (knowing where you body is in relationship to everything else around you). Practice mental imagery inside in a seated position where you will have few distractions. In your imagery practice you should 'be' riding – don't just see yourself riding - actually be riding. Create the scene as completely as you can using all of

your senses. Remain in control of the situation and concentrate on how powerfully and smoothly you are riding. In your imagery, practice riding different climbs, in different situations, and with different competitors. Keep your images real – real time, real sensations, and realistic situations (this is not the time for daydreaming that you are leading the Tour field up the Alp D'Huez). Acknowledge the physical sensations of climbing, even the unpleasant ones and practice riding through the difficulty and discomfort. Keep your initial imagery practice short, 5-10 minutes at the most and focus on remaining in control all the images you create.

Self talk is a useful technique for coping with the negative thoughts that creep into your heads when the going gets tough, such as "I'm never going to make to the top!" or "I'm getting shelled". Effective self talk practice starts with creating a list of some of the negative or downright nasty things you say to yourself when you get frustrated or anxious on a climb. Next create strong positive countering statements to replace each of the negative ones. In order for self talk to be effective the counter statements you create must be positive and they must be something you believe. Your counter statement should refocus your attention on your strengths, your effort, and your determination. Then, whenever one of the nasty statements pops up immediately acknowledge it (say STOP) and replace it with the positive counter statement. For example, I might replace "I'm never got to make it to the top" with "Keep it steady, you know you have the motor". This may feel a little awkward at first but over time it will feel more natural and it will provide you with the confidence boost you need when the going gets tough. **-Kristen Dieffenbach Ph.D.**

Fear starts with a lack of confidence in a rider's fitness. In a race once a ride feels they are "on the limit" they get very nervous. Physical conditioning aside, there are skills and techniques that a rider can learn to help cope under these conditions. We work on skills and techniques designed to help the rider be more economical going uphill and faster downhill. Teaching the rider to keep their attention focused up the road to anticipate changes in terrain is the place to start. Knowing what is coming lets the rider plan ahead for increases in tempo or grade. Gradual changes in pace and pre-shifting and using the drive train more efficiently can help the rider avoid the sudden accelerations that waste energy. If gaps do open, DON'T PANIC. Be patient and close the gap gradually and conserve as much energy as possible. If the gap remains or grows, they need to stay within their ability and try to limit the damage. Once the climb is finished, fast descending will help them make up some of the time. If the pace slows, and the rider is comfortable, they should use their momentum to keep their pace steady and slide up a few places. When a rider is under pressure I have them focus on landmarks that are short distances away. When they reach that point, they move their focus a manageable distance up the road again keep a steady rhythm. This mental focus can help the rider stay positive and ride within their ability.**-Steve Madden**

How does physical conditioning affect the mental side of climbing?

Physical conditioning has a huge effect in the mental side of climbing, and in all race situations for that matter. When a rider has confidence that they have trained properly and are at a point where they are physically fit for a climbing race, they can start the race with a great deal of confidence and will exert less self induced pressure to perform past where they think they are in their physical development. Being properly trained and at a given point of fitness will also give the rider physiological abilities to handle the physical pain of the intense effort, make it so they can stay mentally focused because their ability physical ability to tolerate lactate and the pH balance within the cell that is more acidic, and give them the ability to know if they do get dropped on the climb, they will be able to recover quickly so they can chase back on the main pack or break away group on the down hill or on the flat. **-Kevin Lee Lippert**

Physical conditioning has a direct effect on the mental game in climbing. That is, the more you work on climbing, the more confident you'll be. This doesn't mean that the rider should just climb a lot, but it means they should do various types of intervals on different inclines in order to gain focused fitness. It's important to do long, 10-20 minute intervals at lactate threshold, but also to do 2-5 minute repeats at chase tempos above lactate threshold. The key in climbing is first to be able to maintain a particular race tempo, but after that, it's to be as efficient as possible at that tempo. A good example of this principle comes from mountain bike racing. Unlike road racing where the sprint comes at the end, the mountain bike racer often faces a sprint at the beginning of a race that leads to a big uphill push. The issue is to be in the top five to the hill, then to maintain over the first climb. What I have shown, however, is that once the rider can accomplish staying in the lead group, it then becomes important over the entire length of the race as to how he or she RECOVERS from that early sprint and climb. The pretenders can get to the front, but they fade badly over the long haul. So, the first principle for the mountain bike rider facing this sort of a climb is to warm up exceedingly well--I advocate the use of stationary trainers to get the proper warm-up length and intensity. Secondly, they must have incorporated this sort of sprint/climb into their training using intervals that increase not only their race speed, but also their efficiency in these maximal efforts. In climbing, focused work that which replicate race conditions, counts as much or more than in any other area of cycling. **-Tom Ehrhard- Ph.D.**

Physical conditioning, and more importantly the perception of one's conditioning, plays an enormous role in an athlete's ability to climb. If an athlete doesn't believe they can efficiently ride up a grade, they will create a self-fulfilling prophecy situation and they will not be able to do it. This becomes a vicious cycle of "I can't do it-- See I knew I couldn't do it -- I'll never be able to do it." and off the back you go again.

It is very important for an athlete to believe in the preparation he or she has done. Confidence in training starts with a good understanding of proper training. As a coach, I make it a point to make sure that my athletes understand the purpose of each workout and of the training cycles. Knowing what they are doing and why throughout the training cycle provides athletes with a better understanding of their own preparation. Further, a solid understanding of his or her level of conditioning better equips the athlete to set realistic and challenging goals to strive for when climbing. **-Kristen Dieffenbach Ph.D.**

Fitness and ability fosters confidence and helps the rider relax. Even the best climbers will find themselves under pressure sometimes. They do not panic. They stay within their limits and press on knowing that their conditioning is better than the majority of the field. Fitness, at all levels, and for all cycling applications, is an ongoing process. The rider needs to be reassured that, as their fitness improves, so will their performance. Even if they never make it to the front group, they are still competing and it is important that they train and improve so they can bring the best possible fitness to the battle. Many riders get it in their heads that they are will never be with the top climbers. This may be true but they still need to be encouraged to train and improve so that going uphill does not have to always be unpleasant. Better conditioning = better performance =more confidence, in all conditions. **-Steve Madden**

At would point does a cyclist become a confident climber?

I think the point where a cyclist becomes a confident climber is when they know where they are at within their training/physical development, what their physical limits are at a specific time and they are able work within these limits to maximize their performance. In a confident climber, you will also find the ability to look at the bigger picture with an uncritical but observant and studied eye when analyzing all of the race circumstances and happenings. One of my main focuses when working with riders, especially in very hard races like ones with major climbs in them, is to limit the majority of the self-induced performance stress, focus on the larger picture of what happened in a race or what is happening at the moment, how they can maximize their performance in a given race and to focus on where they are at in the process in obtaining their ultimate goals.**- Kevin Lee Lippert**

The racer becomes a confident climber they succeed in a challenging race situation. There is no way around that--you must succeed against good competition to start building confidence. That starts in training, where you begin to hang with good climbers during focused climbing training sessions or weekly club "hammerfests". Still, I see riders all the time that do well in training rides but bomb in the race--they still lack confidence and need some mental imagery, positive self-talk, and more importantly, a coach or fellow rider who challenges them to improve and holds them accountable for that improvement. Part of the mental game is being on a good team or club that genuinely helps riders work on their weak spots through focused, planned training, and challenges ALL their riders to improve. It may come as a shock to some, but the team aspects of cycling are critical to rider improvement and confidence. Being skinny with a giant VO_2Max helps, but it takes a team--and race success--to develop a confident climber.**- Tom Ehrhard Ph.D.**

Confidence comes from hard work, careful preparation, and well defined goals and expectations. Confidence in one's self and one's abilities is not something that can be created or pepped up the night before a big event, it is something that is built across time. When an athlete believes that he has followed a solid training plan and knows that he has put in the time and effort in following that plan, he will have what he needs to be confident in his ability to confront the challenges of ascending. However, even confident well prepared athletes experience moments of uncertainty. Often, as a coach, I may have to remind a stressed or anxious athlete of the work he or she has done in preparation for an event, but ultimately, I can not create confidence for an athlete who hasn't done the work.**-Kristen Dieffenbach Ph.D.**

I think a rider can be confident of their climbing ability when they are able to "hold" the pace and not get dropped from the front group. The next step is to be able to help "set" the pace that creates the selection and separates the top finishers from the rest of the field.**-Steve Madden**

Instructions: Read the article and choose the answer that best answers the question.

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1. According to Friel the bottom line in building confidence in climbing is to have the ability to maintain near, or above lactate threshold. But other lower intensity abilities are also important. They include:
A. Solid aerobic conditioning, force, skills and muscular endurance.
B. Solid aerobic conditioning, bike fit and muscular endurance.
C. Bike fit, force, skills and muscular endurance.
D. Solid aerobic conditioning, force, skills and starting strength.

2. What is the 2-to-1 rule in cycling as it pertains to effective climbing?
A. Have a work-to-rest ratio of two-to-one for hill training.
B. Have a rest-to-work ratio of two-to-one for hill training.
C. Train hills two times for every one time on flats.
D. Two pounds of body weight for every inch of height.

3. When preparing a cyclist for climbing, why are playing mental games not recommended?
A. When done it gives the cyclists a false sense of security.
B. It gives athletes the impression that we are trying to create an illusion or trick to help them improve.
C. It makes the athletes too competitive at the start of a climb.
D. It will distract the athletes during the ascent.

4. Effective self-talk practice starts with:
A. Try to catch up to the closest rider on the ascent and start talking about something that is totally unrelated to the climb.
B. Never let a negative thought enter your head but if it does, counter it with negative statements.
C. Coming to realize that you are in a state of fatigue or anxiety during a climb.
D. Creating a list of some of the negative things you say to yourself when you get frustrated or anxious on a climb and then create positive countering statements to replace each of the negative ones.

5. Practicing mental imagery should be done:
A. Inside in a seated position where you will have few distractions for 5-10 minutes.
B. Outside on a bike slowly riding where you will have few distractions for 5-10 minutes.
C. Outside on a bike slowly riding where you will have few distractions for 10-20 minutes.
D. Inside in a seated position where you will have few distractions for 10-20 minutes.

6. What bike skill should be done to reduce the anxiety of climbing by climbing economically?
A. Keep the rider's attention focused up the road to anticipate changes in the position of competitors, decreases in tempo or grade gradual changes in pace and pre-shifting and using the drive train more efficiently can help the rider avoid the sudden energy robbing accelerations.
B. Keep the riders attention focused on the power meter increasing power to try and stay with the wattage planned for the ascent, then plan ahead for increases in tempo or grade gradual changes in pace and pre-shifting and using the drive train more efficiently can help the rider avoid the sudden energy robbing accelerations.
C. Keep the riders attention focused up the road to anticipate changes in terrain, plan ahead for increases in tempo or grade gradual changes in pace and pre-shifting and using the drive train more efficiently can help the rider avoid the sudden energy robbing accelerations.
D. Keep the riders attention focused up the road to anticipate changes in terrain, plan ahead for increases in tempo or grade gradual changes in pace and pre-shifting and using the drive train more efficiently can help the rider avoid unplanned decelerations.

7. Confidence comes from:
A. Hard work, careful preparation, and well-defined goals and expectations.
B. Family support, good coaching and achievable goals.
C. Being able to rely on your power meter, careful preparation, and well-defined goals.
D. Hard work, family support, and well-defined goals and expectations.

8. Present the self-talk positive response to a negative statement that you use most commonly with your riders.

Answer Sheet and CEU Application Form

Question #1_____ Question #2_____ Question #3_____ Question #4_____ Question #5_____ Question #6_____
Question #7_____
Question #8 (please limit to 250 words) _____
_____
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NOTE: This Answer Sheet is Valid for Volume 16 Number 7 ONLY!

1. Was the material ___new ___review?

2. Was the material: Presented clearly? ___(Y/N) Covered adequately? ___(Y/N)

3. Suggestions: _____
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I attest that I have read the article(s) and answered the test questions for the above volume and issue number using knowledge gained through the article(s) provided in this issue. A passing grade of 70% or better is required for CEU to be awarded.

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Before Bikefit
Addressing Foot/Pedal Asymmetry: Part 2

Nick Dinsdale BSc (Hons), MSc, MSST, Nicola Dinsdale BSc (Hons), MSST NJD Sports Injury Clinic, Clitheroe, Lancs. UK

Graduate Sports Therapists Nick and Nicola Dinsdale, father and daughter team, run NJD Sports Injury Clinic in Clitheroe, Lancs. UK. The family clinic is recognised for its strong evidencebased approach to the management of sports related musculoskeletal injuries and its keen interest in working with competitive cyclists. Patients include professional cyclists from across the various disciplines, in addition to British Nick Cycling officials. Nicola

Nick specialises in foot dysfunction and how it impacts on cycling performance. This article contains unique findings taken from his own research recently carried out at Manchester Metropolitan University. Nick has worked with The Great Britain Cycling team both domestically and overseas and is a past National CycloCross Series winner.

Nick Dinsdale

Nicola Dinsdale

Introduction

BGN INT XTP MSR MTB

This two-part article will hopefully provide the competitive cyclist with an opportunity to acquire those all too elusive marginal-gains which can represent the difference between success and failure. Both parts closely examine the role of the foot/pedal interface arguably the most common source of pedalling asymmetry. Part 1 highlighted key aspects of biomechanical / anatomical screening before Bikefit from a clinician's perspective. We (authors) strongly believe screening is an area often neglected, undervalued, or misunderstood.

In Part 2, we now investigate different approaches to address the common problem of asymmetry arising from the foot/pedal interface. Although limited published robust research exists, we will apply what does exist, in an attempt to provide sound reasoning to justify our claims. Different approaches include the controversial issue of In-The-Shoe Wedges versus Cleat Wedges; and the emotional topic of Wedges (shims) versus Musculoskeletal Rehabilitation strategies.

The Foot

The human foot comprises 26 bones, 19 muscles, and 107 ligaments, these musculoskeletal structures work together with the neurovascular elements to provide support, balance and locomotion during gait, and power transfer during cycling. Most appropriately, the foot was once admirably described by Leonardo da Vinci as "a master piece of engineering and a work of art".

The foot/pedal interface, arguably the main source of pedalling asymmetry, is the mechanical link between the leg and the cycle and according many authors, including Paul Swift (**www.Bikefit.com**) the foundation for a great Bikefit. As highlighted in Part 1, reduced power output and overuse injuries, particularly knee related, are frequently linked to the anatomic structure of the foot and/or lowerlimb alignment problems (i.e. excessive pronation). This is because the structure and function of the foot and lowerlimb alignment dictate how effectively pedal forces are transmitted via the foot/pedal interface down to the cranks, and potentially, how deleterious forces are transmitted up the kineticchain.

However in an attempt to provide an open and comprehensive approach, we wish to point out that excessive foot pronation, especially unilateral, can be a compensatory mechanism for faulty biomechanics in the pelvis, hips, and a consequence of unilateral anatomical leglength difference (LLD), thus appropriate screening is crucial before attempting to address foot/pedal interface issues.

Modern Technology Increases Foot/Pedal Pressures and Pronation

While modern cycling technology and rider strength has made rapid advancements over the last couple of decades, the human foot has remained unchanged. Rigid carbonfibre frames and carbon wheelsets have improved stiffness and power transfer. Consequently, there is less flex for energy to dissipate. Jarboe and Quesada (2003) demonstrated that carbonfibre shoes are 42% stiffer in longitudinal bending and 550% stiffer in threepoint bending compared with plastic shoes. While these rapid improvements in modern technology, compounded by everimproving rider fitness/strength provide more efficient power transfer, they have come at the expense of increased forefoot pressures at the foot/pedal interface. Past studies have demonstrated increasing power outputs lead to higher peak forefoot pressures, (causing the foot to collapse inwardly), which in turn, can lead to forefoot problems and increased foot pronation.

Forefoot Varus or Forefoot Supinatus

Before examining the different approaches of addressing pedalling asymmetry arising from the foot/pedal interface; it is important we define, or at least consider forefoot varus and forefoot supinatus. The forefoot varus versus forefoot supinatus is a widely debated topic within the field of podiatry. Forefoot varus is a congenital osseous (bony deformity), whereas forefoot supinatus is an

acquired soft tissue contracture that holds the forefoot more inverted (supinated position) during nonweightbearing examination. Forefoot supinatus is considered to be a result of foot posture/position related to excessive foot pronation that occurs over time, probably over many years. When addressing the two conditions for gait activities, the consensus of literature, although very limited, suggests they require distinctly different interventions, failure to do so, can exacerbate the problem. However in cycling, since there is no requirement for the first metatarsophalangeal joint to dorsiflex to provide forward propulsion via the action of the windlassmechanism, differentiation between forefoot varus and forefoot supinatus is unlikely to be such a problem. Therefore, like the vast majority of Bikefit organisations, we (authors) believe that when fitting wedges for cycling the need to differentiate between forefoot varus and forefoot supinatus becomes unnecessary. However, this is not the case when considering approaches that rely on musculoskeletal rehabilitation strategies.

Addressing Pedalling Asymmetry by Wedges

Wedges are designed to cant either the forefoot, or the entire foot, thereby address any misalignment of the foot and/or lowerlimb. Correct wedging permits the foot to be accurately aligned in a more neutral position. Wedges can instantaneously improve pedalling symmetry, which, in turn, can enhance pedalling efficiency, eliminating wasteful energy expenditure, thereby enhance comfort and power transfer. Essentially, there are two different types of wedge, namely the In-The-Shoe Wedge (ITS) shown if Figure 1a, and the Cleat Wedge as shown in Figure 1b. Both wedge types are made from plastic and can be used to address either varus or valgus tilts simply by reversing the wedge.

Figure 1a
In-The-Shoe Wedges

Figure 1b
Cleat Wedges shown in position

What Does the Research Say?

Many of the claims related to the benefits of both Cleat Wedges and ITS Wedges are anecdotal. Although little published research exists on their application and/or performance benefits; they remain widely used and appear to provide instant benefits at minimal expense. In a robust repeatedmeasures design study, Dinsdale (author) and Williams (2010) examined the effect of ITS Wedges on cycling performance in riders with varying levels of forefoot varus / forefoot supinatus. Unlike previous studies, this study reported forefoot varus measurements for each rider, and the corresponding number of ITS Wedges used in testing. Unique to this study, the results demonstrated a strong correlation between power output and cyclists with varying amounts of forefoot varus / forefoot supinatus. Consequently, those with the highest levels of forefoot varus / forefoot supinatus demonstrated increased anaerobic mean power outputs of approximately 10%.

Which Wedge Type Should I Use?

Wedge choice can be a very controversial topic. Unfortunately, like many aspects of cycling biomechanics there is limited published research to justify selection or preferred choice. Most Bikefit organisations tend to prefer the Cleat Wedge and report good results – but in some cases this may be achieved by default. We will now attempt to explain when and why each of the two different wedge types should be selected. Then we will discuss musculoskeletal rehabilitation strategies.

Cleat Wedge versus ITS Wedge

In our opinion, and logically, varus aligned Cleat Wedges should be used primarily to address the tibial varum factor which is common to the vast majority of people. Tibial varum is the natural bowing of the lower third of the tibia (bowlegged) represented by a typical 3 to 4 degree angle (Figure 2). When the foot is unloaded (openchain) the inside aspect (bigtoe) of the foot is elevated in relationship to the outside of the foot. When the foot is loaded (closedchain) the inside of the entire foot must roll inwards (pronates) to make contact with the pedal platform. Pronation is a natural compensatory movement owing to the tibial varum factor. Cleat wedges accurately align (cant) the entire foot and hold it in a more neutral position. Where, ITS wedges should be used primarily to address forefoot varus. Forefoot varus is a forefootrearfoot alignment problem (Figure 3); the 1st MTP joint (big toe) is elevated from the pedal when the rearfoot is in a neutral position. ITS wedges are designed to address this alignment problem between the forefoot and rearfoot. Whilst most cyclists would benefit from Cleat wedges to address the natural tibial varum factor, for some unknown reason, many Bikefit organisations measure forefoot varus using a goniometer (Figure 4) and subsequently fit Cleat wedges. Furthermore, Pierrynowski and Smith (1997) report that the subtalar neutral position is the most widely used reference point for the clinical measurement of the relationship of rearfoot to forefoot (forefoot varus), yet this appears to be infrequent practice in many Bikefit scenarios.

In summary, we believe that the vast majority of cyclists would benefit from varus aligned Cleat wedges to address natural

Figure 2

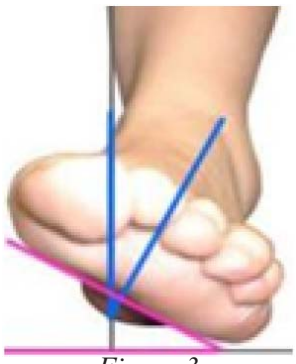

Figure 3

Figure 4

Figure 5

tibial varum. Ideally, ITS wedges should be used in combination with Cleat wedges, when and if, forefoot varus has been reasonably established. An indicative test for fitting varus wedges is; if your knee moves inwardly, and/or if your foot abducts (rotates outwardly) during the pedal downstroke when the foot is subjected to reasonably high pedal forces (Figure 5).

Arch Supports: Are They Necessary in Cycling?

Hannaford et al (1986) demonstrated that simple longitudinal arch supports are not adequate, as stand alone, to support the foot when high pedal forces move forwards directly over the forefoot during the pedal downstroke, especially during intense efforts. However, when ankling between 10 and 2 o'clock of pedal revolution, the ankle is often in a dorsiflexed position, the foot is then more susceptible to pronation, and therefore the longitudinal arch may collapse slightly, inwardly. Therefore, the use of a firm longitudinal arch support to complement varus wedges can be justified and is likely to prove beneficial, especially for short intense cycling events. A common problem with some commercial cycling insoles is that the longitudinal arch support is insufficiently dense/firm and incapable of providing support under high pedal loads. More importantly, if the longitudinal arch extends too far forward the arch will interfere with the 1st Metatarsophalangeal joint, preventing the metatarsophalangeal heads from grounding. This results in the pedal forces being transferred through the arch rather than the metatarsal heads of the forefoot.

Musculoskeletal Rehabilitation Strategies

While musculoskeletal strategies involving stretching and strengthening exercises have proved very effective in restoration of muscle imbalance in around the pelvic region and many other areas, there appears little robust evidence to support their efficacy in restoration of muscle imbalances associated with chronic overpronation. If the deleterious effects of excessive pronation were a simple quick muscle restoration issue, there would be far fewer overuse injuries amongst athletes, and less emphasis in the commercial development and marketing of foot orthoses and antipronating running shoes. Nevertheless, as Graduate Sports Therapists, trained first and foremost in musculoskeletal rehabilitation techniques, we would always recommend musculoskeletal rehabilitation (corrective exercises) form part of a comprehensive multifactorial management approach. In the case of true forefoot varus which is a congenital osseous (bony deformity), corrective musculoskeletal rehabilitation techniques are pointless. However, a corrective exercise prescription is likely to be beneficial for forefoot supinatus which is considered to be an acquired soft tissue contracture. The level of benefit, and the duration, required to achieve any benefit are questionable, and can prove expensive. Therefore, we would recommend fitting wedges, then pursuing a suitable musculoskeletal rehabilitation plan simultaneously. If and when the pronatory forces have been controlled with no loss in performance, wedges can be removed.

Consider the Role of the Foot Beyond Cycling Activities

There is growing evidence to suggest that forefoot supinatus (acquired soft tissue contracture) develops over years and is a result of excessive subtalar joint pronation. Although never reported in cycling literature, we strongly believe that when excessive pronation exists, the role of the foot should be examined from both a cycling and gait perspective. The literature at good posture during gait is dependent on foot stability during midstance. Studies by Cobb and colleagues demonstrated that foot pronation displaces the body's line of gravity forward through forward pelvic rotation and levels of forefoot varus >7° cause core and pelvic instability. Thus, failure to address excessive foot pronation in both gait and cycling may lead to core and pelvic instability, leading to postural asymmetry being taken onto the bike.

CONCLUSION

Excessive pronation is prevalent amongst cyclists and is here to stay. Studies demonstrate that as pedal forces increase, pronation increases. Although we have no evidence, we strongly believe that modern carbonfibre equipment further exacerbate pronatory forces. Research indicates appropriate varus wedging can improve cycling performance (power output) by eliminating wasteful energy expenditure. Varus wedges also mitigate abnormal knee movement; which mitigates abnormal stresses up the kineticchain. Wedging is instanteous, and inexpensive. Ideally, a suitable musculoskeletal rehabilitation strategy can run simultaneously while using wedges. Then, if proved successful, wedges can be removed. This assumes there will be zero quantifiable loss in power output. The level of benefit, and the duration, to achieve any potential benefit are questionable. Some longterm rehabilitation strategies can be expensive. Finally, in some cases, we believe abnormal foot dysfunction should be addressed on and off the bike. O

Chain Link: For the bibliography associated with this article please click **HERE**.

Performance Products Whole Brain Thinking and Improved Performance

Dean Brittenham, Owner, Brain in a Bag

*Performance Products provides the fitness marketplace the opportunity to link you to their products' "unique selling points" that sets them apart from others and how these unique selling points benefit the athlete to improve performance and/or injury prevention based on their product claims. We hope you enjoy this series and would appreciate your comments and ideas .***- Ken Kontor**
condpress@aol.com

BGN INT XTP MSR MTB

The latest research shows that to learn and perfect sports specific skills the athlete has a much greater possibility if s/he first dramatically grows his/her brain to the highest possible level – becoming a WHOLE BRAIN THINKER.

There are countless numbers of research projects taking place all over the world in university labs, private labs and government labs, classrooms, and the athletic fields all finding the unbelievable potential to harness and develop the brain and body.

The major discovery is the brain has unlimited potential for growth (through the making mental maps) by growing new brain cells, dendrites, and synapses. The research says that the major key is doing an abundance of ambidexterity drills, sensory training, and fine and gross body system movements. As the mental maps are developed the body then develops Motor Maps and the great performers in all areas of endeavor have just developed a greater number of mental and motor maps.

Parents, classroom teachers, physical educators, coaches (on all levels) who are looking to develop great students, super soccer players, volleyball players, baseball players, cyclists, basketball players and all other sports need to first grow the individual's brain.

For the past twenty years researchers, and authors have been writing that everyone has practically unlimited potential for brain growth, everyone could become a WHOLE BRAIN THINKER ie: a GENIUS. Becoming a whole brain thinker is about activating both the right and left hemispheres, and the corpus collosum and this is what the great geniuses have exhibited, Thomas Jefferson, Ben Franklin, Michelangelo, Edison, and the number one genius of all time Leonardo Da Vinci. The great news is what the research says that we need to do a tremendous number of ambidexterity drills, bilateralism activities, and sensory expansion programs. This all leads to all people becoming ambidextrous and the common thread of the previously mentioned people ALL were ambidextrous as have been the great performers of our present time, Michael Jordan, Larry Bird, Pele, Babe Ruth, Pete Sampras, Roger Federer, Diane Taurase, Serena Williams, Payton Manning, Tom Brady to name a few.

With the goal of growing the brain and becoming a whole brain thinker the number one priority is to become ambidextrous and the number one activity is to learn to juggle. There is concrete evidence as to the value of juggling. Two research projects one at the University of Regensburg and the University College of London both showed the value of learning to juggle. Both studies did a MRI of the entire class at the start of a semester, each study then had half of the class learn to juggle. At the University of Regensburg the group that learned to juggle had a brain growth of 3% and at the University of London the juggling group had a brain growth of 4% and at both Universities the non juggling students did not have any brain growth. Can you imagine how much brain growth that you will have as you do 30 to 60 various types and variations of juggling?

Juggling exercises integrates the "right and left hemispheres" resulting in growing the brain for whole brain thinking. Research has shown the there is a direct relationship between Hand-Eye coordination and the ability to Read and Write. With all of the evidence from thousands of studies it is critical to start doing an abundance of ambidexterity, bilateral, and sensory expansion activities so that your student-athletes can become whole brain thinkers. As the athletes become whole brain thinkers they now will be more ready to learn and perfect sport specific skills.

Educators and researchers are predicting that an Educational Tsunami is going to strike the U.S. and the rest of the world. The number one activity will be juggling and various types of juggling activities, along with a great variety of footwork drills. By growing the brain and becoming a whole brain thinker, and perfecting these athletic skills, your athletes and students are now ready to learn, perfect, and perform their sports specific skills on a tremendously high level.

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Chain Links: Contact the author at **deanbritt@yahoo.com**
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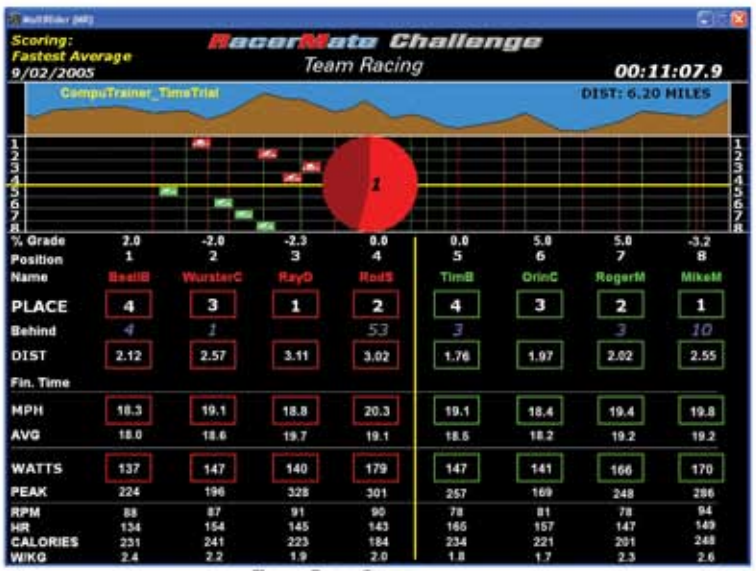

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From the USAC Coaching Education Department

If you are not currently a USA Cycling certified coach but would like to become one, you can find the answer to many of your questions on the USA Cycling website (**www.usacycling.org**) in the Coaching Program area. The entry level (USAC Level 3) is a home study course that includes the newly developed Introduction to Coaching Cyclists.

USA Cycling offers further certification and educational opportunities. The next level of certification is level 2. The level 2 certification clinics are held several times a year throughout the country. Information on the agenda and schedule can be found at the above referenced website. In addition to the certification clinics, USA Cycling offers a Power Based Training Clinic.

A recent addition to the USA Cycling Education program is webinars. These web-based seminars take advantage of computer and internet technology. The webinars cover a variety of topics. Information on the webinars can be found on the Coaching Program page of the USA Cycling website. Webinars are open to anyone. Some webinars are free; most webinars have a fee.

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