Bike Fitting Consensus Statements
Summary Document

The goal of this task force is to educate both the medical and the at-large cycling communities about definitions and concepts in bicycle fitting. This consensus statement should only be used as a guideline and should not replace a consultation with a trained bicycle fitting professional or an evaluation with a medical professional.

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1) A professional bike fit usually has these components:

- An initial one to three hour bike fit, with potential follow-up fits if needed
- An interview with the cyclist during which the fitter collects various data points such as goals, history, etc
- An on-bike and off-bike objective evaluation
- Modifications of the bike based on the evaluation
- Other services such as posture training, corrective exercise instruction, pedaling mechanics, and flexibility/strength/stability training can also be included

All components of the bike fit are dependent on the training and skill level of the fitter. Bike fitters that goes beyond their level of training can result in poor outcomes for the bicyclist.

2) Benefits and goals of a professional bike fit can include:

- Help riders accomplish their individualized riding goals.
- Increase the safety of bicycle operation. Safety considerations include the avoidance of poor handling, such as front wheel toe overlap, inappropriate front wheel weight distribution, appropriate reach to brake lever, and saddle type for a rider. Proper position and bicycle equipment will allow optimization of bicycle handling for a given condition.
- Optimize the comfort for the rider. The bicyclist should be able to maintain bicycling posture without undue stress or strain to the involved musculoskeletal components. Putting in the bicyclist in a position that decreases postural strain will help avoid pain

syndromes or overuse injuries related to prolonged periods on a bicycle.
- Increase speed by putting the rider in a position on the bicycle will increase power, mechanical economy, efficiency and aerodynamics.

3) Tools commonly used in bike fitting:

Common	**Less Common**
Goniometer	Size Cycle - Fit Bike
Plum line	Motion Capture Systems 2d/3d
Tape Measure	Spin scan or similar
Laser	EMG / Muscle evaluation tools
Stationary Trainer	Branick Foot Measuring Device
Level - Angle locator	Scales for front to rear wheel wt distribution
Basic Bike tools	XY Tool
Adjustable Stem	Power measuring devices

4) Factors affecting bicycle fit/positional outcome:
- Goals of the bicyclist
- Experience and skill of the bicyclist
- Cyclist's level of conditioning and general health
- Cyclist's medical condition - taking into account injuries, surgeries, and other pathologies
- Any anatomical constraints the cyclist may have - muscular flexibility / joint mobility / strength /core stability / coordination / asymmetries in the body - for a most common list of musculoskeletal limitations see Document A
- The cyclist's current bicycle and/or components may be inappropriate for the bicyclist.
- Demands of bicycling discipline (road, time trial, recreational, track, mountain, cyclocross, etc). Transferring fitting data from one type of bike to another does not work.
- Current and past sport history, including sports other than bicycling.

5) Common overuse injuries and pain syndromes related to cycling:
- Knee pain
- Low back pain
- Neck and/or shoulder pain or dysfunction (especially on Tri / TT)
- Hand pain and/or numbness
- Foot pain and/or numbness
- Ankle pain or stiffness (Achilles, Peroneals)

- Perineum pain and/or numbness
- Others not listed here

In dealing with these common dysfunctions, the fitter should always start by moving a cyclist toward a neutral position to correct inefficient biomechanics. Many times, neutral fit eliminates enough stress on aggravated areas, making accommodations unnecessary. Any accommodations that are made are not optimal, in that some aspect of cycling is being compromised in order to accommodate for another aspect. Thus, these accommodations can have short-term or long-term consequences on the cyclist's efficient biomechanics and handling of the bike. The goal of the fitter is to remove accommodations over time as the cyclist no longer needs them. Interventions can include education, treatment, or any other modality that is within the scope of knowledge and practice of the fitter.

6) Bike fit categories

- **Non-Accommodated** / **Optimal Range Fit**: Able to accomplish all the goals of the fit with the cyclist inside optimal ranges for the type of cycling they are performing. - The fitter and cyclist are able to find THE IDEAL INDIVIDUALIZED POSITION that best accomplishes all goals of the cyclist in that moment.

The bike is 'wedded' optimally to the cyclist and the cyclist is wedded optimally to the demands of the sport and minimal to no accommodations were needed to be made. Each cycling discipline has different demands, and thus has different idealized positions. For some generalities around an 'optimal' road cycling position see the supplemental document.

- **Accommodated Fit**: Not able to accomplish all the goals of an optimal fit due to some limitations. These limitations are usually due to some deficiency of the rider, but are occasionally due to a frame that is an inappropriate size for the cyclist. In an accommodated fit, some objectives of an optimal fit are compromised in order to compensate for the deficiency.

  An accommodated fit is ideally a transitional position. This means that the fit process should not stop at an accommodated position. Instead, the fitter should work with the cyclist (or refer the cyclist to a qualified professional) in order to resolve the deficiencies that were accommodated for. See supportive document for some usual musculoskeletal dysfunctions that are frequently accommodated for

7) Interfaces to the bike / Contact Points

- Foot - Pedal Interface:
  - A shoe that fits the cyclist is critical for comfort and economy.
  - Generally, most people will do best with a small cycling-specific supportive insole. When it comes to wedging / supporting / canting - shimming. etc. As with the rest of the bike for every accommodation around a foot there are side effects and consequences that can affect the rest of the system
  - The team frequently sees too much overuse / inappropriate use of this contact point to affect the system when the dysfunction is not coming from this contact point. If the fitter is supporting the foot more than 2-3 mm varus or 1 mm valgus then further evaluation and or treatment should be considered. As mentioned

below any leg length shimming is recommended to see a medical professional before going there.

- Pelvis - Saddle Interface
    - A saddle should be 'about level' (+/- up to 2.5 degrees) interfacing with the rider such that the rider experiences 'most' of the pressure on the 'bony parts of the pelvis' (pubic rami) and not the 'soft parts' - perineum including arteries, nerves and pelvic floor muscles. Saddle should also be in line with the top tube of the bike.
    - Many things affect this interface, the most important including: saddle type, health of the rider and one must remember the other contact points at such as the rider's hands and feet.

- Hands - Handlebar Interface
    - A rider should be able to comfortably ride in all positions of the bars. This is especially true at the brake hoods where he / she should have easy access to the breaks with efficient upper body position (see optimal bike position)
    - The cyclist should feel 'light' in their hands if the appropriate position has been achieved such that they are able to support themselves with their feet and core while his / her hands land lightly on the bars

One must recognize that each contact point and joint in the body can affect others, which means that the body is a connected kinetic chain and finding an issues at one contact point or joint does not necessarily mean that the issues is coming from that location. This is due to a closed kinetic chain interface with hands, feet, and pelvis.

8) Conditions that may warrant referral to a medical provider

- More than minimal accommodations are made outside of an optimal fit due to pain, dysfunction, neuromusculoskeletal inefficiencies and dysfunction.
- Pain or problems persist after several bike fit attempts
- Conditions that cause pain on the bike continue after the cyclists stops the ride
- The cyclist exhibits neurological or radicular symptoms
- The cyclist exhibits mechanical joint symptoms (locking, catching, popping, swelling / warmth)
- The cyclist displays ANY leg length discrepancy (functional or structural).
- The cyclist has medical issues that are not orthopedic in nature, including urogenital pelvic dysfunction, others as appropriate.

If the fitter encounters any of these issues, it might be appropriate for the fitter to **stop** a bike fit and immediately refer the cyclist to a medical provider.

9) How does one decide on a fitter ? Qualities and assets a good fitter should strive for.

- The cyclist having pain or dysfunction should consider seeking a fitter with medical training and more fitting experience

- reputation in the cycling, fitting and medical communities
- fitting experience and education - certifications, professional development etc.
- understands the type of bike that they are fitting -- type of fitter
- good rapport with the individual cyclist

Some Basic Definitions:

- Frame Geometry:

Top Tube, Seat Tube, Head Tube - all measured from center of the intersecting tube for uniformity

- Torso angle: measure from the horizontal to a line that is drawn between the hip and shoulder
- Knee angle: greater trochanger - knee joint axis - lateral malelous

- Bike measurements

Core four:

- Seat to bar ir hood reach (C2):
- seat to bar drop (D),
- Seat height(A) - BB to CENTER of the saddle,
- Seat setback(B)

- Bar width: measured at hoods Center to Center
- Cleat shim: device placed between the shoe and the cleat, usually plastic
- Inside the shoe wedge: wedge placed inside the shoe for canting the foot (usually forefoot)
- Retrofit: changing the bike the client brought in
- Fit bike: Adjustable bike that can be used for determining appropriate fit parameters on a new bike or to transfer back to the client's bike

Other

- Builders and respected fitters in the industry: http://www.framebilderscollective.org/
- UCI regulations on fitting / frame geometry

- http://www.uci.ch/Modules/BUILTIN/getObject.asp?MenuId=&ObjTypeCode=FILE&type=FILE&id=NjUxMTY&LangId=1
- http://www.uci.ch/Modules/BUILTIN/getObject.asp?MenuId=&ObjTypeCode=FILE&type=FILE&id=NTI0MDY&LangId=1

Research Articles

- Christiaans HH, Bremner A. Comfort on bicycles and the validity of a commercial bicycle fitting system. Appl Ergon 1998, 29(3) 201-11
- Gonzalez H, and Hull ML. Multivariable optimization of cycling biomechanics. J Biomech 1989; 22(11-12), 1151-61.
- Gregor RJ and Wheeler JF. Biomechanical factors associated with shoe/pedal interfaces. Sports Med 1994 17(2) 117-31
- Ruby P, Hull ML, Kirby K, Jenkins D. The effect of lower-limb anatomy on knee loads during seated cycling. J Biomechanics 1992 25(10): 1195-1207.
- Ruby P, Hull ML. Response of intersegmental knee loads to foot/pedal platform degreesof freedom in cycling. J Biomech. 1993 Nov;26(11):1327-40.
- Usabiaga J et al. Adaptations of the lumbar spine to different positions in bicycle racing. Spine 1997 1 22(17) 1965-9.
- Detori NJ, Norvell DC. Non-traumatic bicycle injuries : a review of the literature. Sports Med. 2006;36(1):7-18.

Learning Resources

Books:

- Andy Pruitt - Medical issues in Bike fitting.
- Burke ER. Proper fit of the bicycle. Clin Sports Med 1994 Jan 13(1) 1-14.
- The Ultimate Ride, Chris Carmichael, Putnam Books

Bicycle Fitting Programs (alphabetical order)

BikeFit - www.BikeFit.com
BikePT - www.BikePT.com
Cyclologic - (coming soon) www.cyclologic.com
Fit Kit - www.bikefitkit.com
Retul - www.Retul.com
Serotta - www.serottacyclinginstitute.com
Specialized - www.specialized.com
Slow Twitch - www.slowtwitch.com
Trek - www.trekbikes.com

Wobble-Naught