

BIKE FIT AND KNEE PAIN IN CYCLISTS

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TRYSports (CHAPEL HILL, NC)

OBJECTIVES

- UNDERSTAND AND VALUE THE IMPORTANCE OF AN INDIVIDUALIZED BIKE FIT TO PREVENT AND MANAGE KNEE PAIN.
- UNDERSTAND THE IMPORTANCE OF THE RELATIONSHIP OF BIKE FIT TO KNEE PAIN IN CYCLISTS.
- APPRECIATE THE IMPORTANCE OF THE KINETIC CHAIN AND ITS ROLE IN BIKE FIT AND KNEE PAIN IN CYCLISTS.
- DESCRIBE THE BASIC CAUSES AND THE COMPONENTS OF BIKE FIT THAT CAN CONTRIBUTE TO KNEE PAIN AND INJURY IN CYCLISTS.
- UNDERSTAND THAT ADJUSTMENTS TO BIKE FIT CAN MANAGE AND PREVENT KNEE PAIN IN CYCLISTS.

PRESENTATION HIGHLIGHTS

- BIKE FIT AND KNEE PAIN
- ANATOMY OF THE BIKE AND KNEE
- THE KINETIC CHAIN
- BIKE FIT AND KNEE PAIN: MECHANISM OF INJURY
- COMPONENTS OF BIKE FIT AND ADJUSTMENTS
- CONCLUSIONS

BIKE FIT AND KNEE PAIN

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KNEE PAIN IS THE MOST COMMON LOWER-EXTREMITY OVERUSE PROBLEM IN CYCLISTS.¹

- 42% - 65% OF RECREATIONAL LONG DISTANCE CYCLISTS REPORT OVERUSE KNEE PAIN.

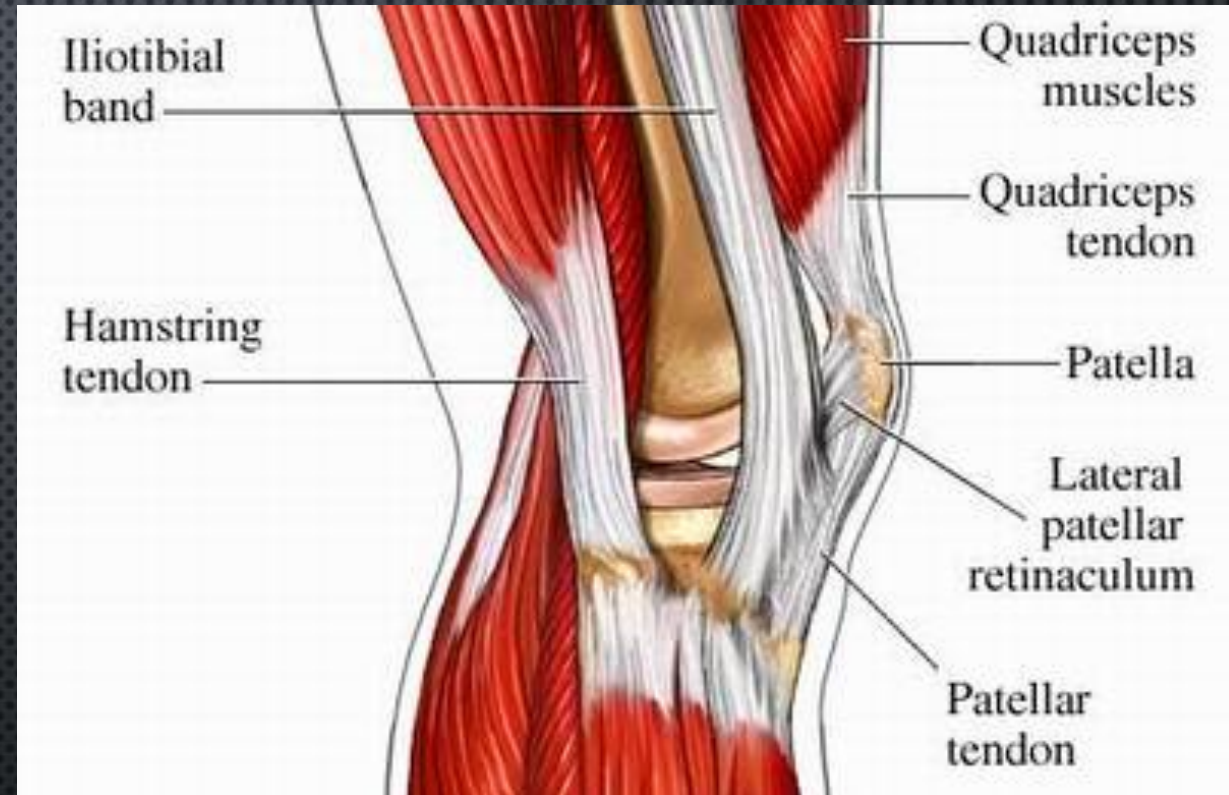
OVERUSE INJURIES OCCUR WHEN A TISSUE ACCUMULATES DAMAGE CAUSED BY REPETITIVE SUBMAXIMAL LOADING.¹

CYCLING IS A REPETITIVE ACTIVITY.

- 1 HOUR = ~5400 PEDAL REVOLUTIONS (3,600-7,200 PER HOUR).²

ANATOMY

ANATOMY: KNEE



<http://ohiodance.org/dance-education/dance-wellness/knee-anatomy/>

<http://www.osteoarthritisblog.com/category/knee-anatomy/>

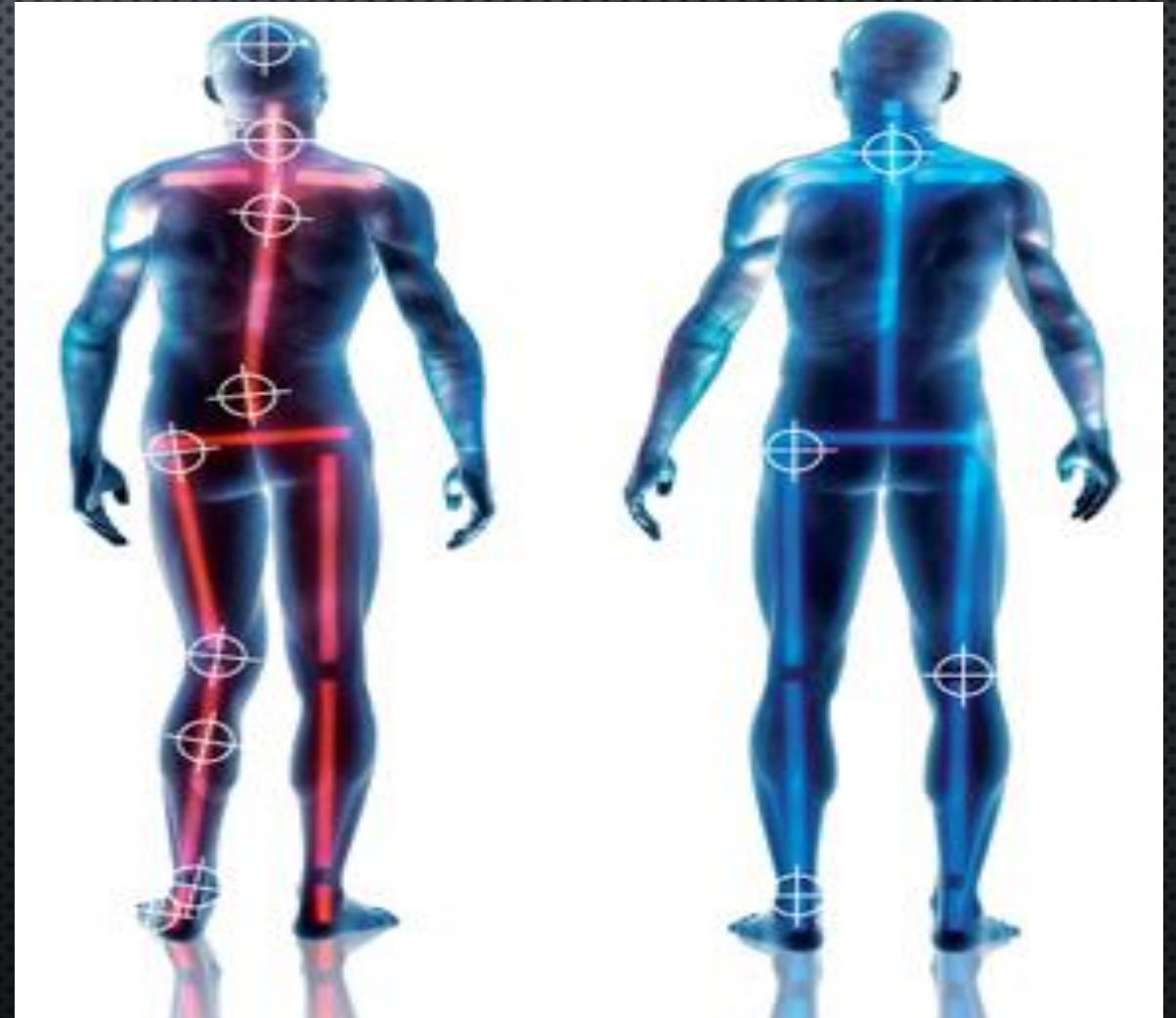
ANATOMY: BIKE



KINETIC CHAIN

KINETIC CHAIN

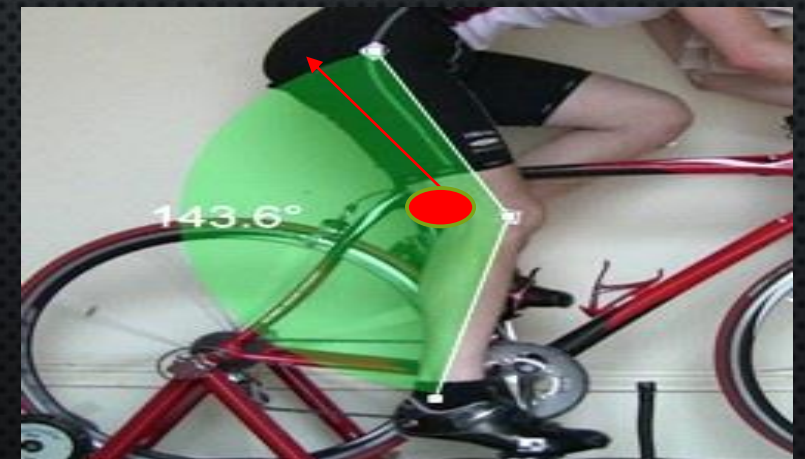
- MOTION AT ONE JOINT CAUSES MOTION AT CONNECTED JOINTS



BIKE FIT AND KNEE PAIN: CAUSES OF INJURY

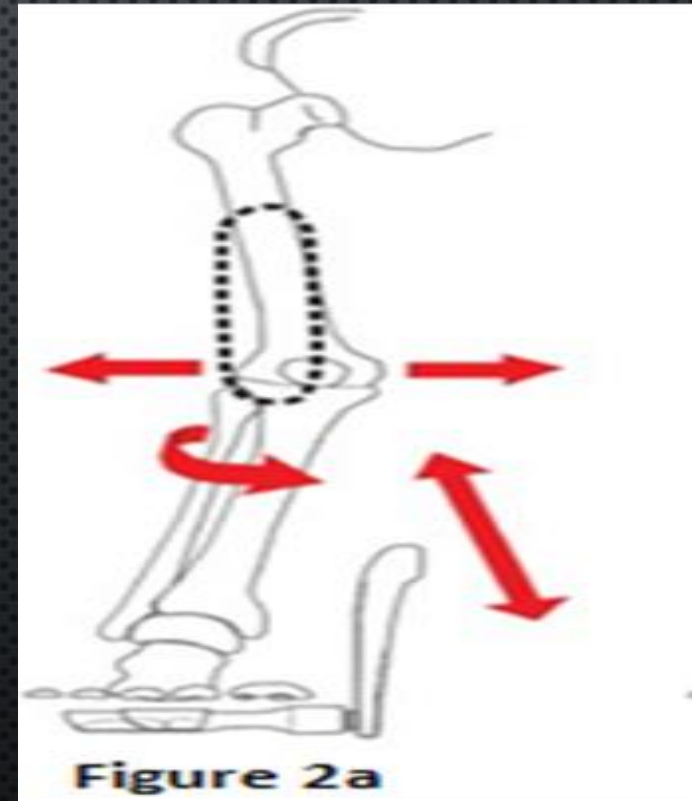
CAUSES OF INJURY

- INCREASED KNEE BENDING INCREASES STRESS ON THE STRUCTURES ON THE FRONT OF THE KNEE.¹
- INCREASED KNEE EXTENSION INCREASES STRESS ON THE STRUCTURES AT THE BACK OF THE KNEE.¹



CAUSES OF INJURY

- INCREASED KNEE ROTATIONAL AND LATERAL MOVEMENTS



COMPONENTS OF BIKE FIT AND KNEE PAIN

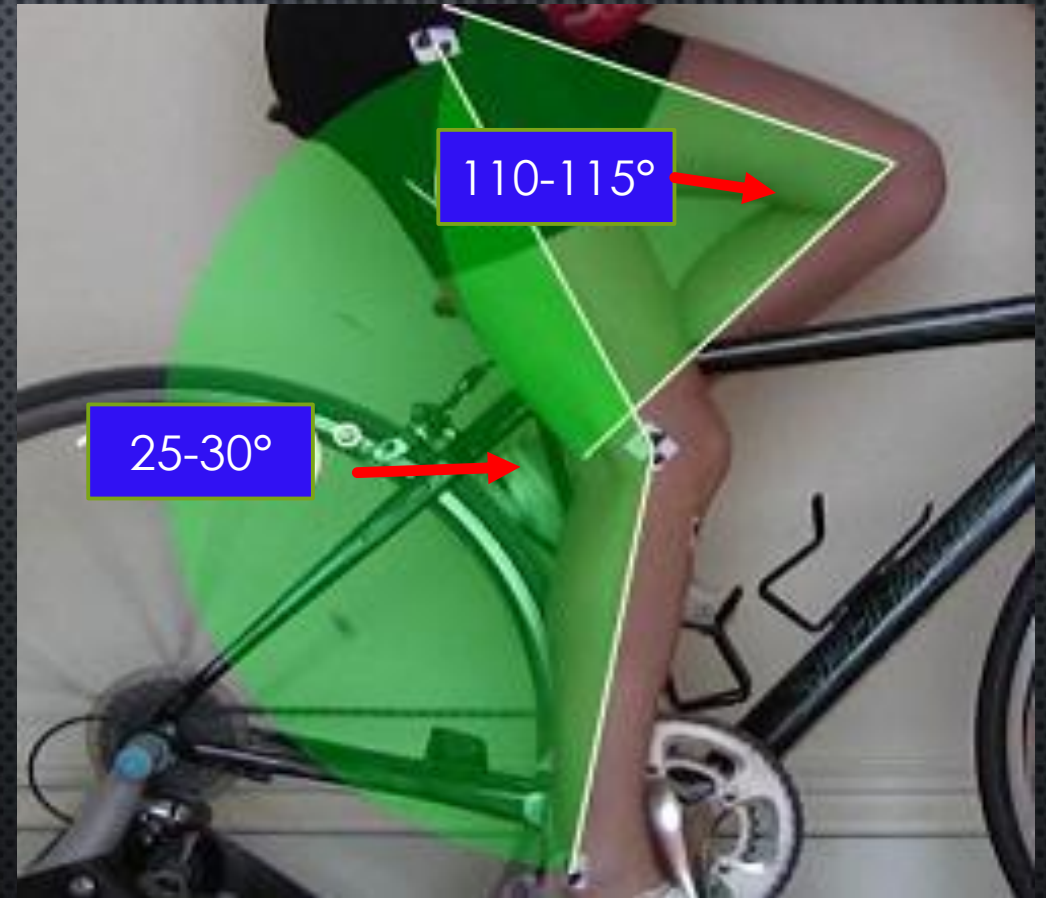
COMPONENTS OF BIKE FIT: SADDLE HEIGHT

KNEE FLEXION ANGLE ³

- **MINIMUM 25-35°**
- **MAXIMUM 110-115°**



STATIC AND DYNAMIC FIT



BIKE COMPONENTS: SADDLE POSITION

FRONT TO BACK POSITION

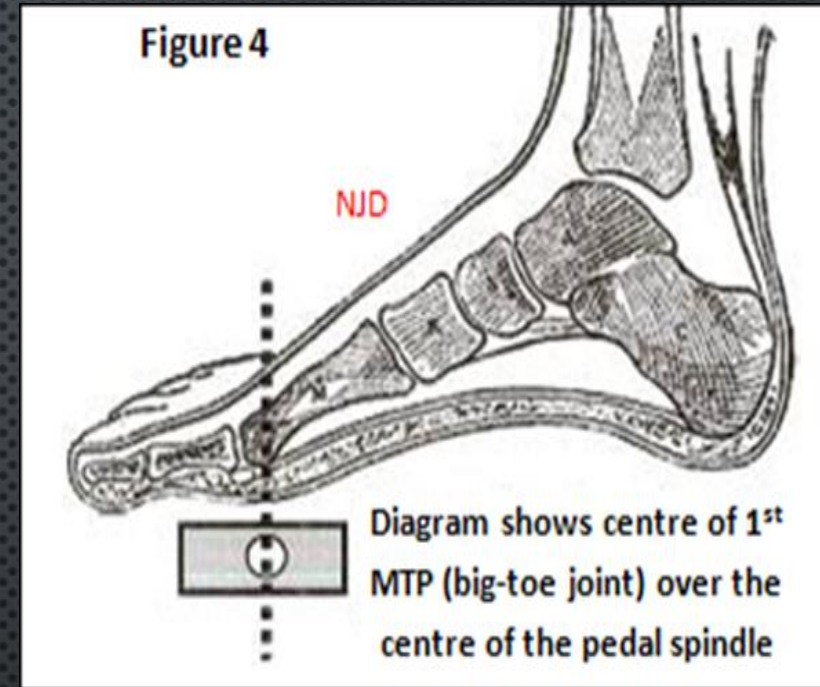
- AT 3 O'CLOCK IN THE PEDAL CYCLE A LINE DROPPED STRAIGHT DOWN FROM THE BOTTOM OF THE KNEECAP SHOULD BISECT THE PEDAL AXIS.
- A MORE FORWARD SADDLE POSITION INCREASES THIS KNEE FLEXION ANGLE.⁴



BIKE COMPONENTS: PEDAL

FRONT TO BACK POSITION

- PLACE THE CLEAT WITH THE CENTER OF THE BIG TOE OVER THE CENTER OF THE PEDAL SPINDLE. ⁵



MOVING THE CLEAT FORWARDS AND BACKWARDS CAN IMPACT THE KNEE AND ANKLE JOINT. ⁶

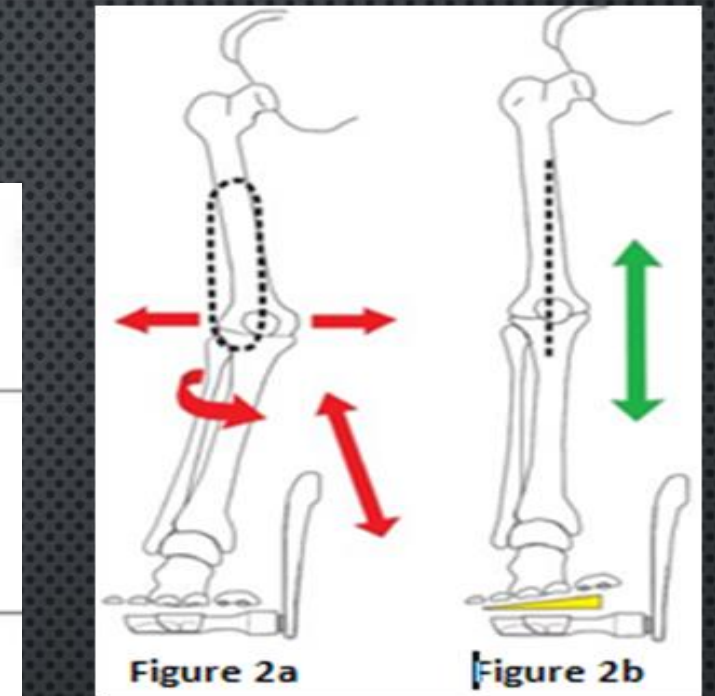
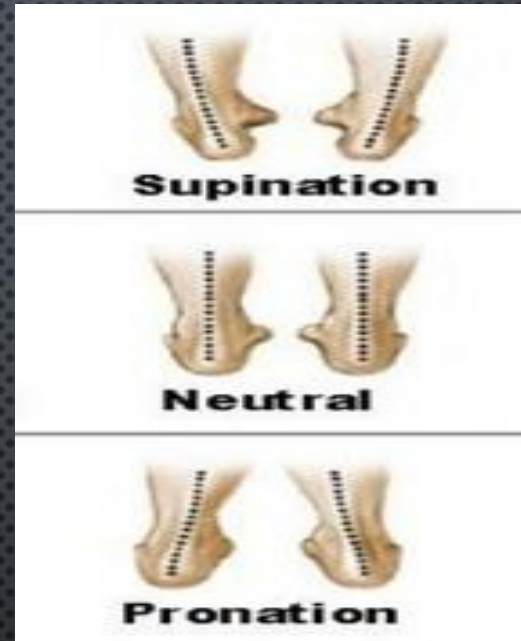
<http://www.njdsportsinjuries.co.uk/Bikefit.htm>

- A MORE BACKWARD POSITION INCREASES KNEE BENDING AND QUADRICEPS ACTIVATION. ⁶
- A MORE FORWARD POSITION INCREASES TENSION ON POSTERIOR KNEE STRUCTURES AND INCREASES CALF ACTIVATION. ⁶

BIKE COMPONENTS: PEDAL

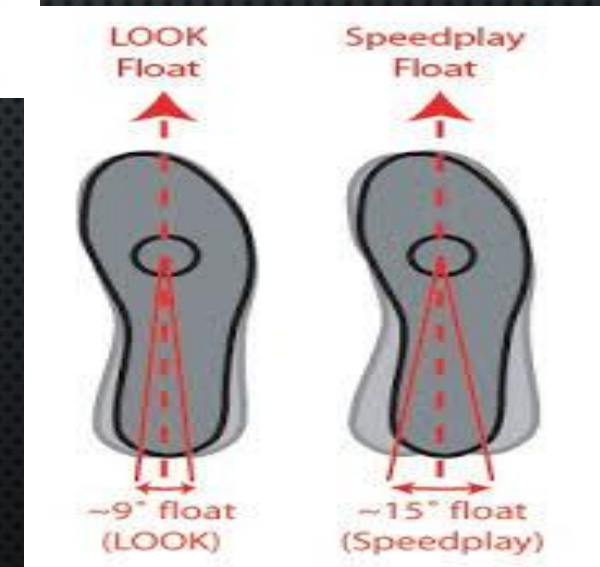
EXCESSIVE PRONATION/SUPINATION

- PRONATION CAN CAUSE A KNOCK-KNEED RIDING POSITION. ^{7,8}
- SUPINATION CAN CAUSE A BOW-LEGGED RIDING POSITION. ^{7,8}



BIKE MODIFICATION

- 5-10° OF FLOAT OR MOVEMENT IS GENERALLY APPROPRIATE. ⁹
- INSOLE ORTHOTICS OR CLEAT WEDGING CAN BE USED ⁸



BIKE COMPONENTS: PEDAL

ROTATIONAL ANGLE (TOE-IN AND TOE-OUT)

- IN MOST CASES 5-10° OF FLOAT OR MOVEMENT IS APPROPRIATE ^{9,10}
- FOR THOSE WITH EXTREME POSITIONING BIAS THEIR CLEAT/SHOE POSITION TOWARDS THEIR NATURAL BODY POSITION. ^{10,11}



<http://bikedynamics.co.uk/kneepain.htm>



[HTTP://WWW.BRAMPTONFOOTCLINIC.COM/TREATMENTS/LIST-OF-TREATMENTS/INTOEING-OUTTOEING.HTM](http://www.bramptonfootclinic.com/treatments/list-of-treatments/intoeing-outtoeing.htm)

BIKE COMPONENTS: PEDAL

LATERAL POSITION (SIDE-TO-SIDE) ¹²

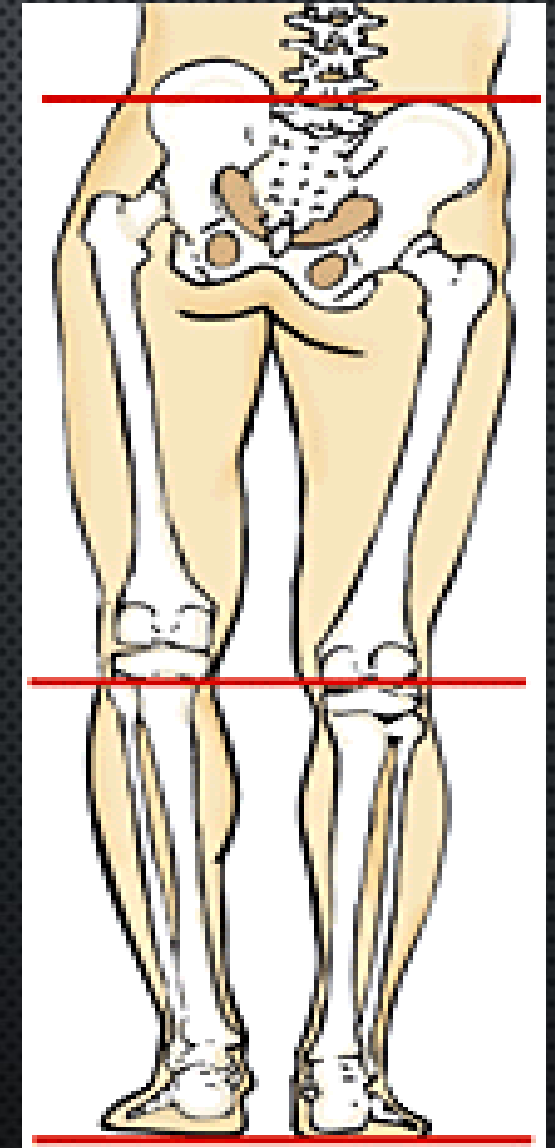
- Q-FACTOR



BIKE COMPONENTS: PEDAL

CLEAT SHIM (LEG-LENGTH DIFFERENCE)

- LEG LENGTH DISCREPANCY GREATER THAN 6MM IS SIGNIFICANT.¹³
 - CORRECT 1/3 TO 1/2 OF THE DISCREPANCY.¹³
- CLEAT SHIM VS. FITTING THE LONGER LEG¹³
- KINETIC CHAIN EFFECTS



BIKE COMPONENT: HANDLE-BAR INTERFACE/BODY POSITIONING

KYPHOTIC POSTURE

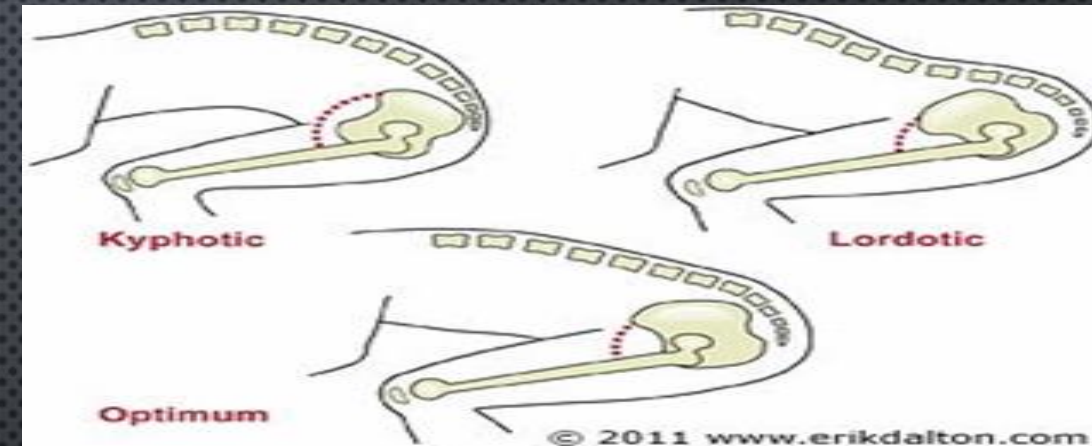
- SHORT TOP TUBE AND/OR STEM LENGTH¹³

LORDOTIC POSTURE

- LONG TOP TUBE AND/OR STEM LENGTH¹³
- HANDLEBARS TILTED DOWN¹³

OPTIMUM POSITION

- HANDS ON HOODS: 45° TRUNK ANGLE¹³
- HANDS ON BRAKES: 60° TRUNK ANGLE¹³
- TOP OF STEM SHOULD BE 1-3 INCHES BELOW LEVEL OF THE SEAT.



<http://erikdalton.com/bad-bodies-or-bad-bike/>



<http://bodybuilding24x7.com/archives/1516>

CONCLUSIONS

- TOO LITTLE, TOO MUCH OR ABNORMAL MOVEMENT
- KINETIC CHAIN
- NEUTRAL VERSUS NATURAL ALIGNMENT
- INDIVIDUALIZE

QUESTIONS?

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