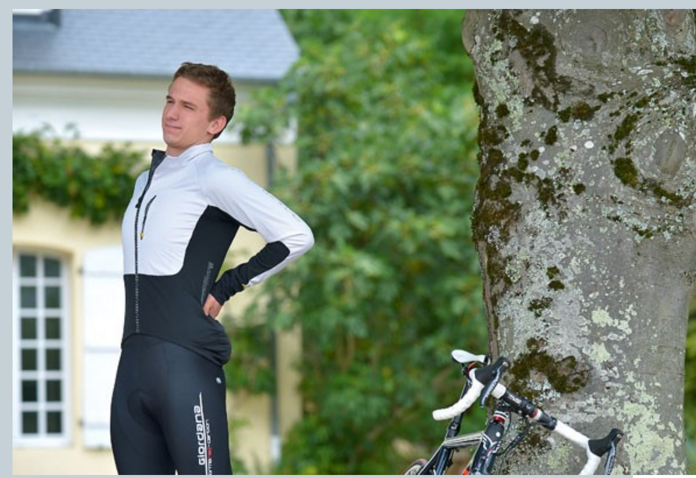
Low Back Pain in cycling

1

DOES IT MATTER HOW YOU SIT?



wannes.vanhoof@faber.kuleuven.be

Science & Cycling
1 & 2 juli 2015, Utrecht

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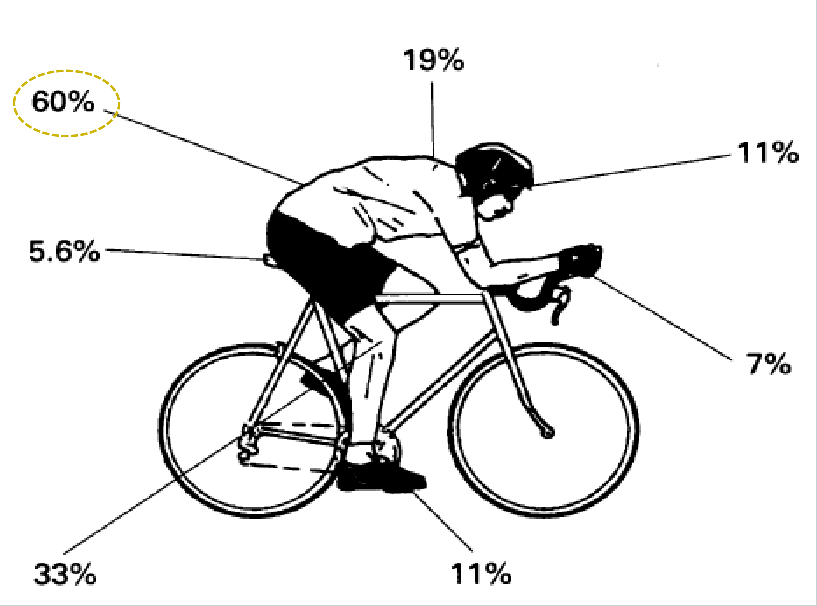
UTRECHT 2015

Content

- LBP in cycling?
- Pathomechanisms
- Multidimensional framework
- What is underlying cycling related LBP?
- Managing cycling related LBP?

LBP in cycling?

- Is a common problem
  - Prevalence: 31 to 60%
  - Elite: 45% (1year incidence: 58%)



[Callaghan & Jarvis, 2002; Salai et al., 1999; Manninen & Kallinen 1996; Mellion 1991, 1994; Clarsen et al., 2010, Dillingham, 1995; Waddell, 1998]

Etiology - pathomechanism

- Based on non-cycling biomechanical laboratory studies
  - Intersegmental forces transferred through the Fl/Rotated TxLx spine
  - Flexion-relaxation phenomenon
  - Muscle fatigue
  - Sustained forward flexion during cycling - increases the risk of tissue irritation or damage (disc ischemia)
  - Mechanical-creep effect
  - (Excessive muscle activation - increased tissue strain across the lumbar spine)

O'Sullivan et al., 2006

[O'Sullivan et al., 2006; Sheeran et al., 2012; Dankaerts et al., 2006; Shirado et al., 1995, Srinivasen et al., 2007; Usabiaga et al., 1997; Brumagne et al., 2003; Garges et al., 2008; McGill and Cholewicki, 2001; Adams et al., 1995; Adams et al., 1994]

Etiology - pathomechanism

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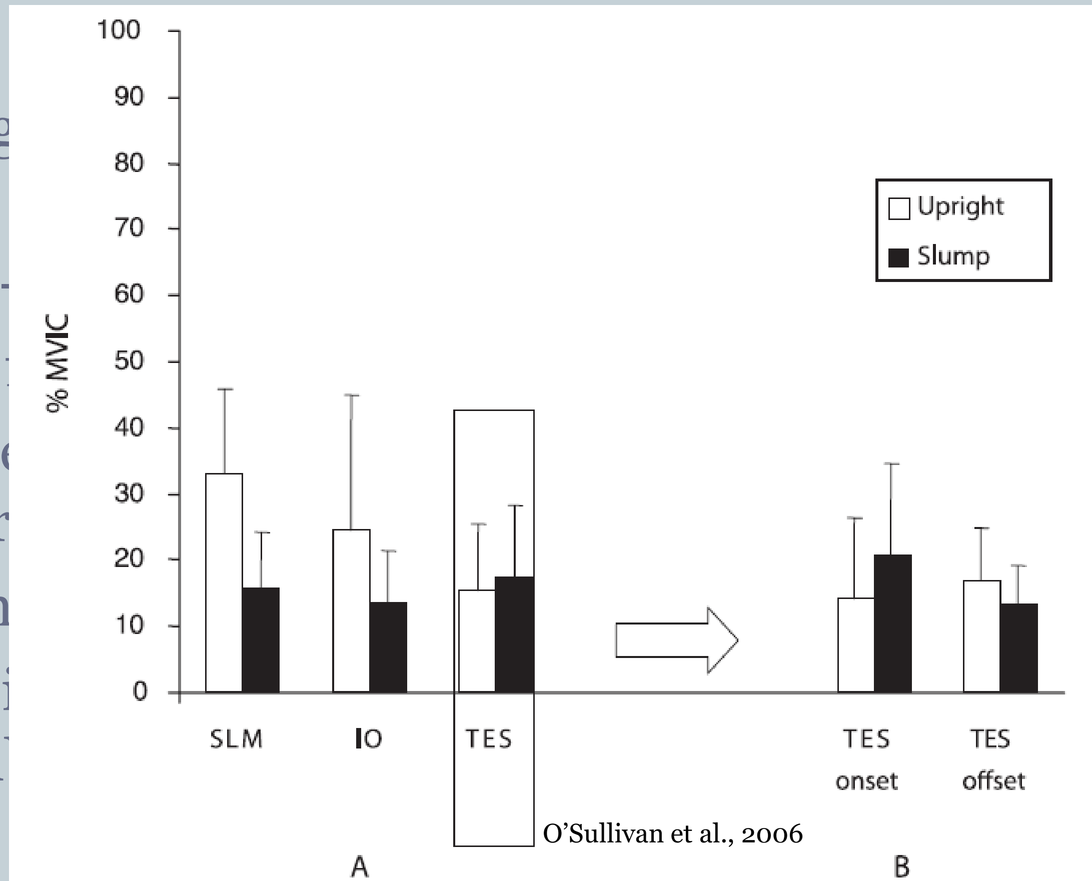
  - (Excessi… …ain across the lum…



O'Sullivan et al., 2006

[O'Sullivan et al., 2006; Sheeran et al., 2012; Dankaerts et al., 2006; Shirado et al., 1995, Srinivasen et al., 2007; Usabiaga et al., 1997; Brumagne et al., 2003; Garges et al., 2008; McGill and Cholewicki, 2001; Adams et al., 1995; Adams et al., 1994]

What is underlying (cycling) related NSCLBP?

What is underlying NSCLBP?

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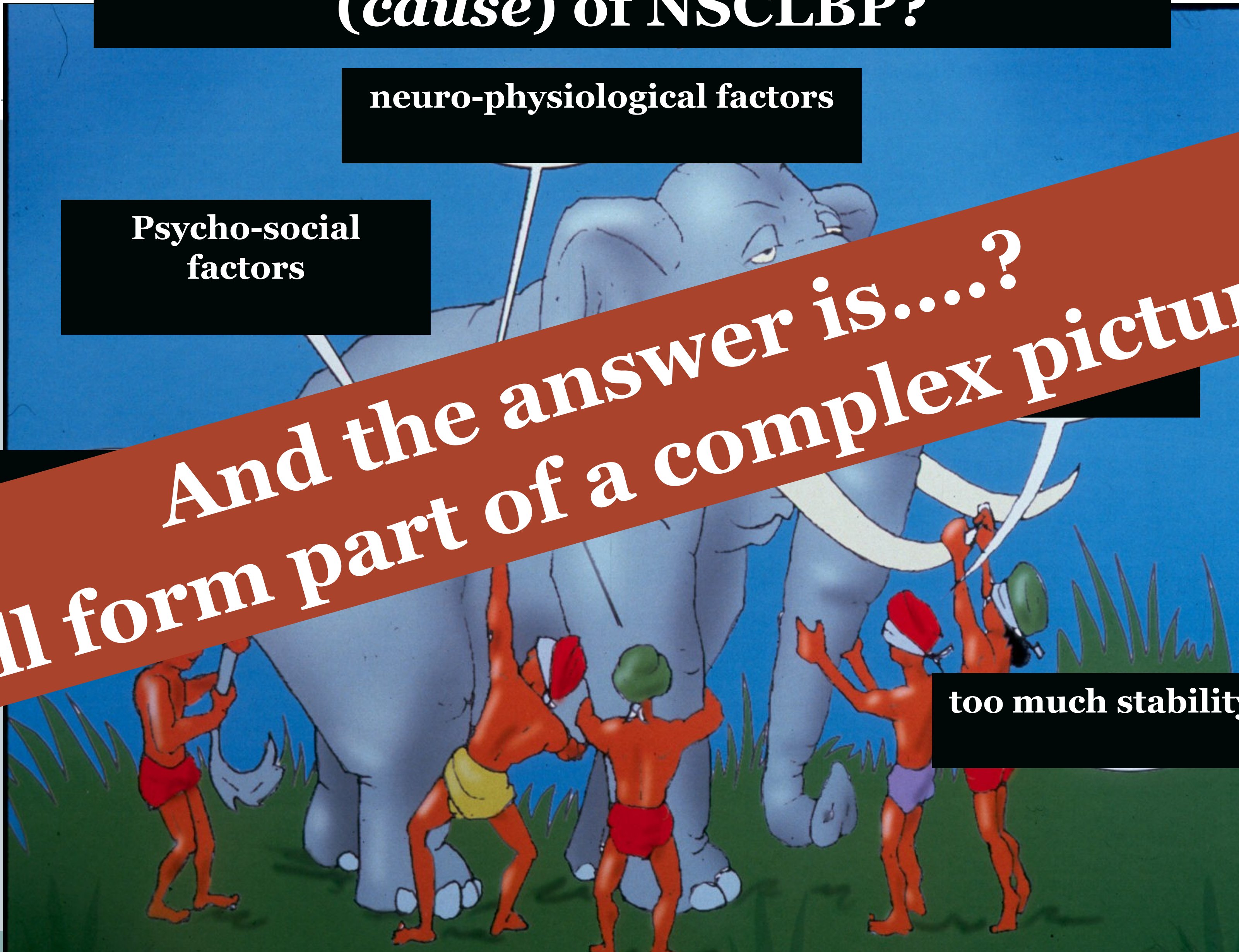
…behavior – posture – beliefs – attitudes (re work/movement/damage) – *advice* *(from hairdresser – chiro – internet)* – **fear** – **previous Hx** – compensation – family dynamics – occupation – sports – **lifestyle – pathology - ….**

Beliefs about LBP

- "I hurt my back, so I will probably have bad back pain from now on"
- "I have back pain, so I sh… n bed and rest"
- "The more ba… e my spine is damaged"
- "My back pain … due to something being 'out of place'"
- "I need a scan or X-ray for my back pain"
- "I need an operation to cure my back pain"

Myths !

What is the underlying mechanism (*cause*) of NSCLBP?



And the answer is….?
All form part of a complex picture

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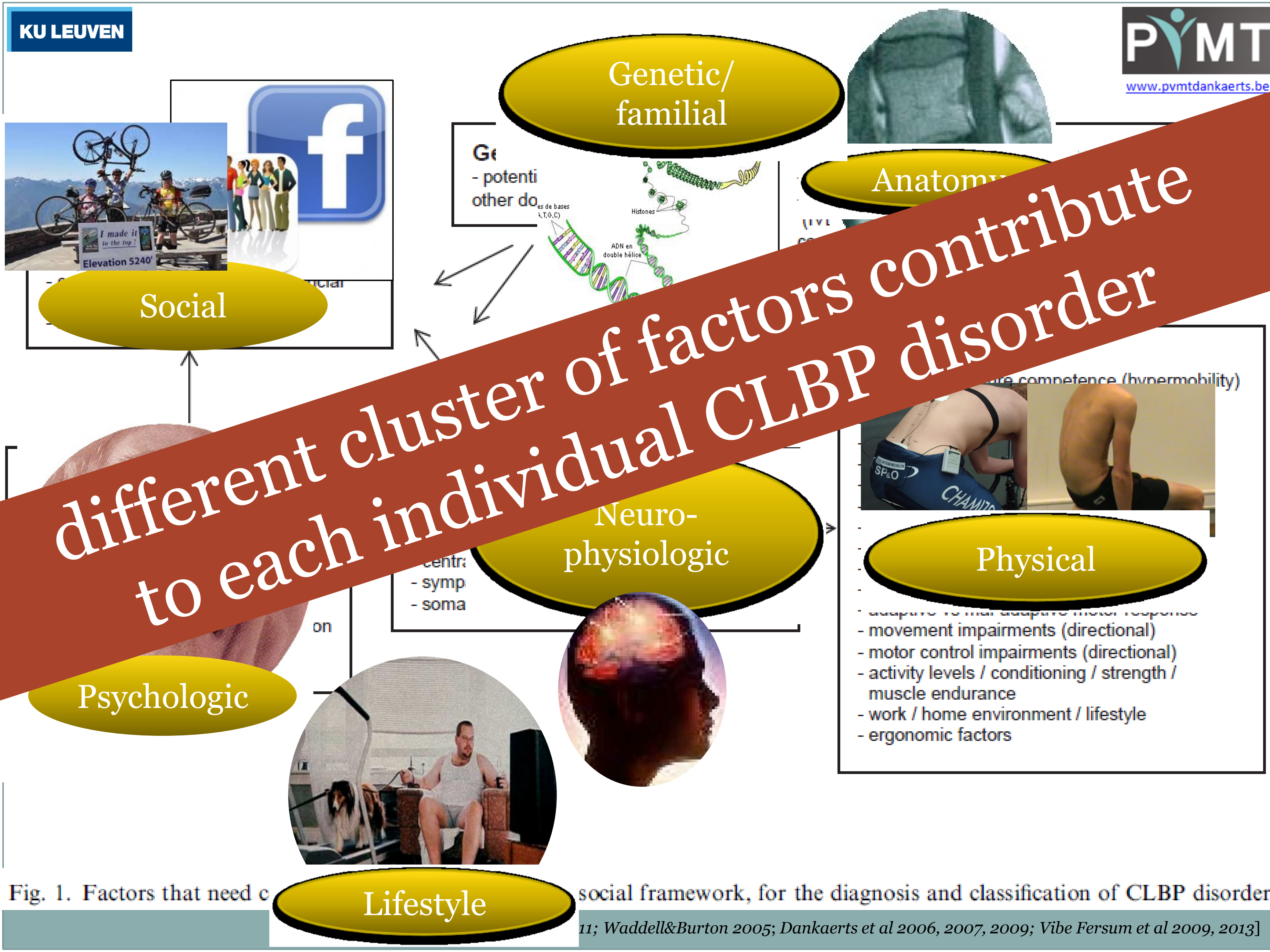
Multidimensional clinical reasoning framework

BASED ON
O'SULLIVAN'S CLASSIFCATION SYSTEM (OCS)

[*O'Sullivan 2005, 2011; Waddell&Burton 2005; Dankaerts et al 2006, 2007, 2009; Vibe Fersum et al 2009, 2013*]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Genetic/ familial
Anatomy
Social
Psychologic
Neuro- physiologic
Physical
Lifestyle
different cluster of factors contribute to each individual CLBP disorder
- movement impairments (directional)
- motor control impairments (directional)
- activity levels / conditioning / strength / muscle endurance
- work / home environment / lifestyle
- ergonomic factors
Fig. 1. Factors that need c… social framework, for the diagnosis and classification of CLBP disorders.
11; Waddell&Burton 2005; Dankaerts et al 2006, 2007, 2009; Vibe Fersum et al 2009, 2013]

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Anatomy

Genetic/ familial

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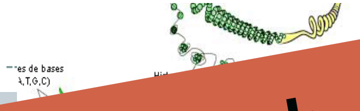
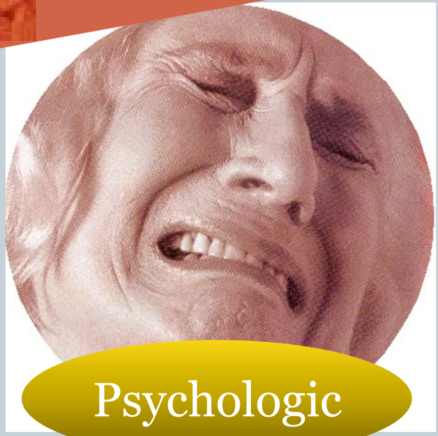


what ... do we find out ... f factors ... CLBP

to pa... disorder...

Social



Psychologic

[O'Sullivan 2005, 2011; Waddell&Burton 2005; Dankaerts et al 2006, 2007, 2009; Vibe Fersum et al 2009, 2013]

Chronic low back pain disorders

Red flag disorders

Cancer
Infection
Inflammatory disorder
Fracture

Specific back pain disorders

- **Spondylolisthesis**
- **disc herniation + radicular pain**
- **degenerative disc + modic changes**
- **foraminal and central stenosis**

Adaptive response
Patients response to disorder is adaptive / protective

Management
Advise, medical, surgical – as appropriate

Mal-adaptive
Patients response to disorder is mal-adaptive / provocative
Control or movement impairment classification

Management
-Medical
- Cognitive / Motor learning
- control or movement impairment directed

Non-specific back pain disorders

Centrally mediated back pain

Eg. 'Fibromyagia'
Regional pain syndromes
Somatisation

Dominant psycho-social factors

Multi-disciplinary management
Psychological (CBT), medical, functional rehabilitation

Non-dominant psycho-social factors

Medical management
Functional rehabilitation

Peripherally mediated back pain

Maladaptive movement behaviours

Control impairment
(directional subgroups)

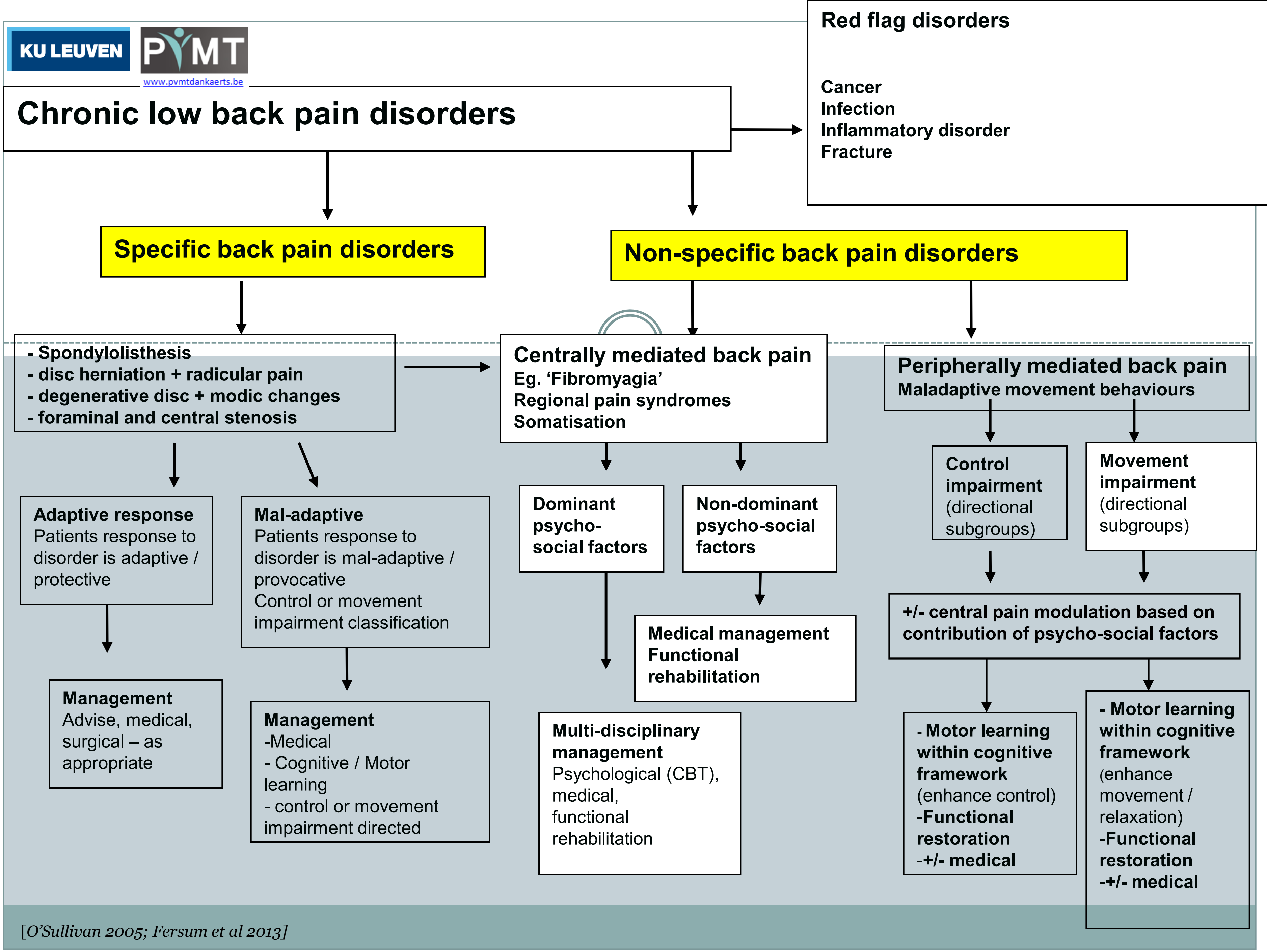
Movement impairment
(directional subgroups)

+/- central pain modulation based on contribution of psycho-social factors

- **Motor learning within cognitive framework**
(enhance control)
-**Functional restoration**
-**+/- medical**

- **Motor learning within cognitive framework**
(enhance movement / relaxation)
-**Functional restoration**
-**+/- medical**

[O'Sullivan 2005; Fersum et al 2013]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Patients response to disorder is adaptive / protective
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Control or movement impairment classification
Dominant psycho-social factors
Non-dominant psycho-social factors
Control impairment (directional subgroups)
Movement impairment (directional subgroups)
Medical management
Functional rehabilitation
+/- central pain modulation based on contribution of psycho-social factors
Management
Advise, medical, surgical – as appropriate
Management
-Medical
- Cognitive / Motor learning
- control or movement impairment directed
Multi-disciplinary management
Psychological (CBT), medical, functional rehabilitation
- Motor learning within cognitive framework
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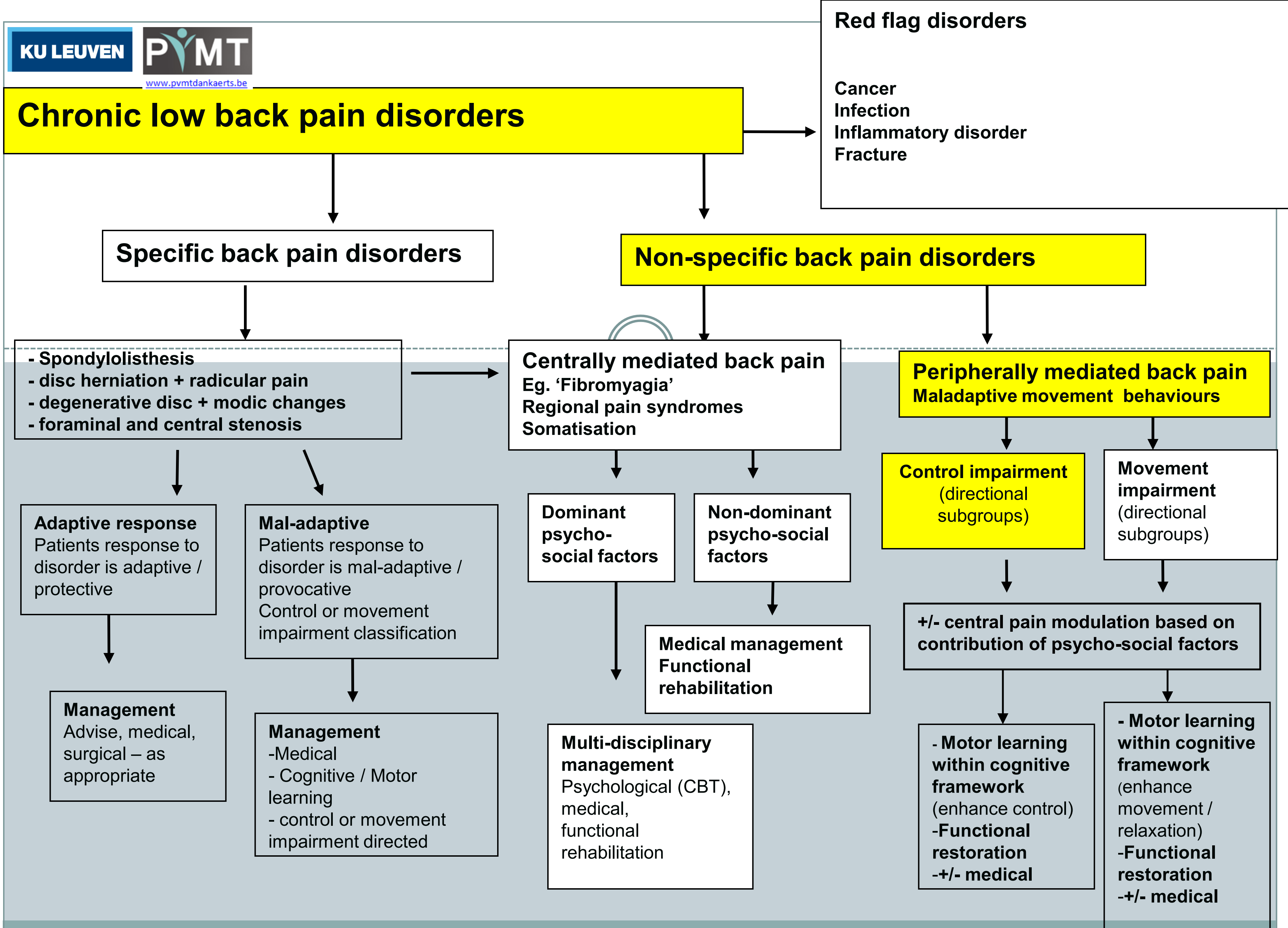
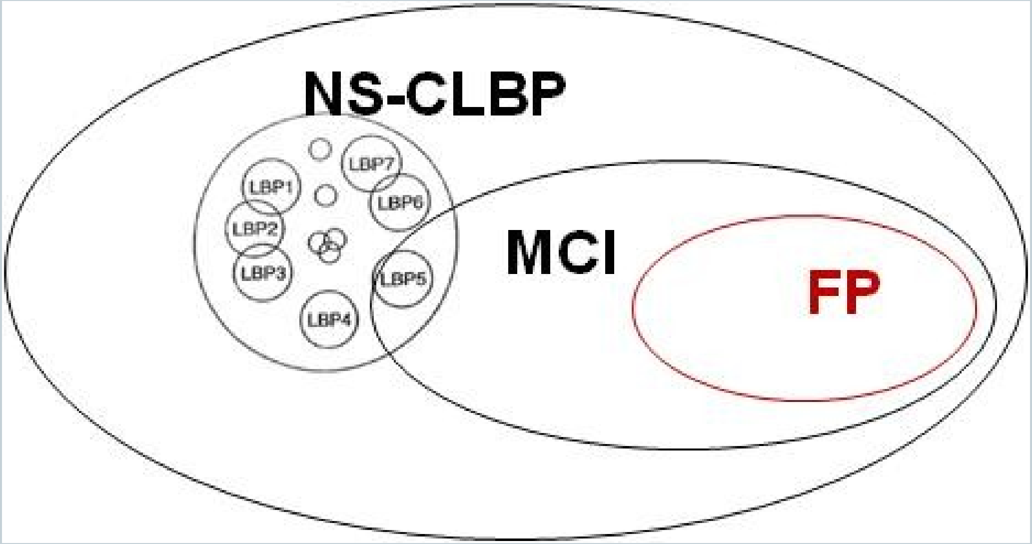
[O'Sullivan 2005; Fersum et al 2013]



[O'Sullivan 2005; Fersum et al 2013]

Motor Control Impairment subclassification

- = a maladaptive pattern of movement or posturing of the spine that results in excessive tissue strain

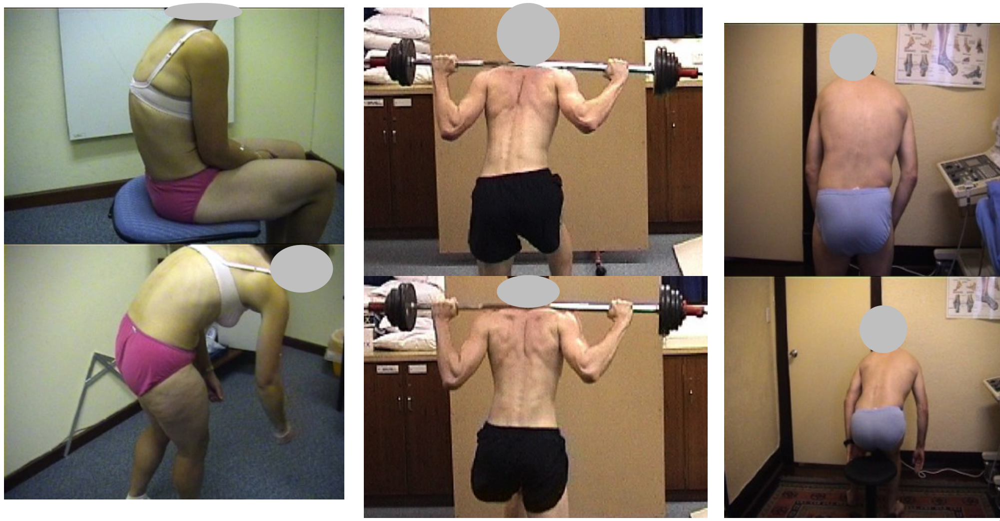


[O'Sullivan 2005; Fersum et al 2013]

NS-CLBP

localised mechanically induced

MCI



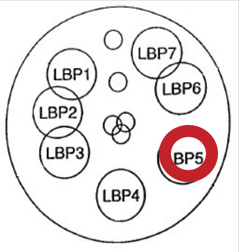
no (segmental) movement impairment in direction of pain

central pain drivers can co-exist: eg
cognitive factors
(fear avoidance behaviours,
poor coping strategies, …)

absence of dominant ‘psycho-social’ features

dominant peripherally mediated pain

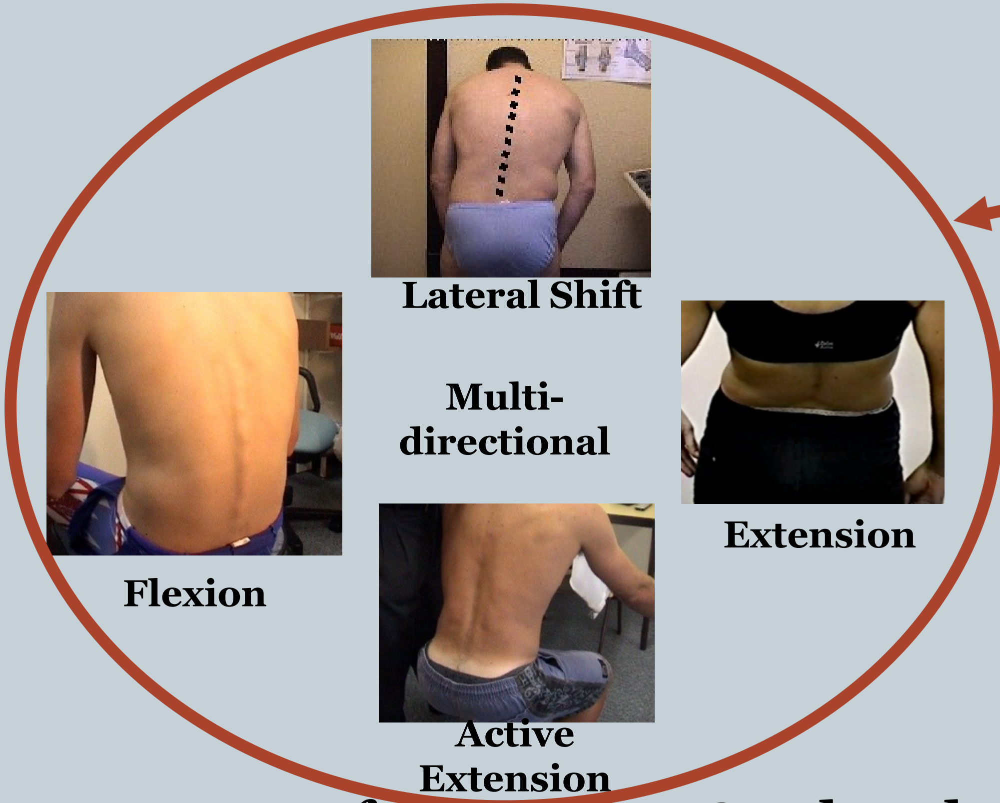
Motor Control Impairment subclassification

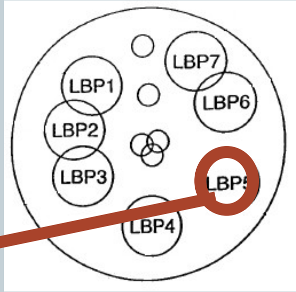


- Localised mechanically induced NSCLBP
- Absence of dominant 'psycho-social' features
- No segmental movement impairment in the direction of pain
- Impairment in spinal control provokes and maintains pain state
- Normalizing control impairment leads to resolution of disorder

Motor Control Impairment subclassification

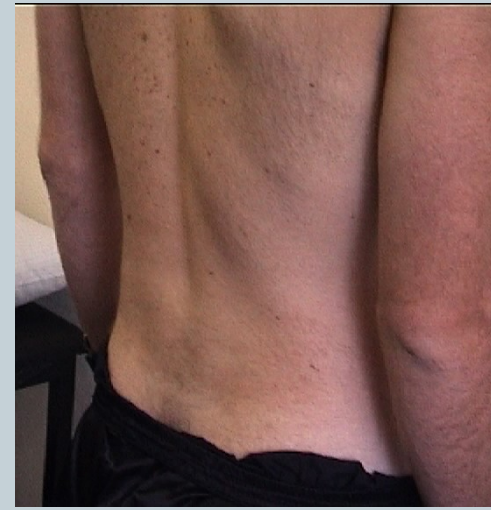
- 5 patterns based on direction of MCI

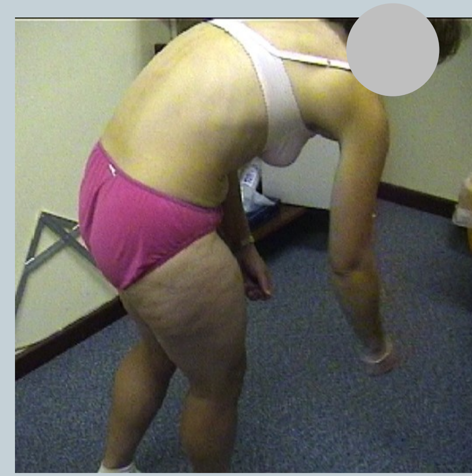




- distinct patterns of altered MCI closely linked to patient's pain behaviour

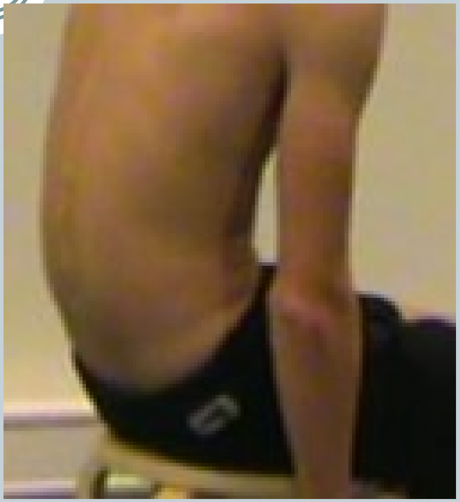
Flexion Pattern





Flexion Pattern

- Most common
- Loss of segmental Lumbar (Lx) lordosis into flexion
- Position in more end-range flexion
- Posterior pelvic tilt
- Repetitive and sustained near end-range flexion strain
- Provocation: flexion and flexion/rotation activities and postures
- Reduction: lordotic/extended postures (lumbar roll/McKenzie ext)
- Inability to independently (from Tx) anterior rotate & extend lower Lx - generate control from Tx



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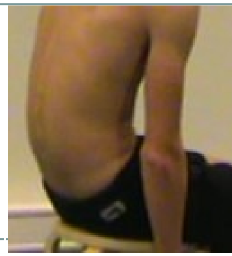

Flexion Pattern

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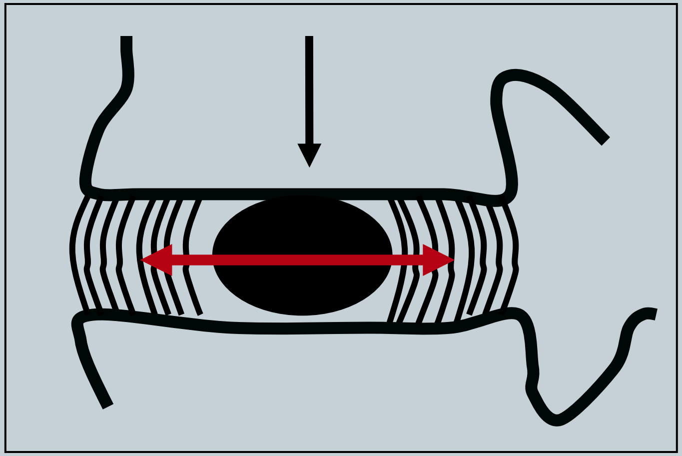
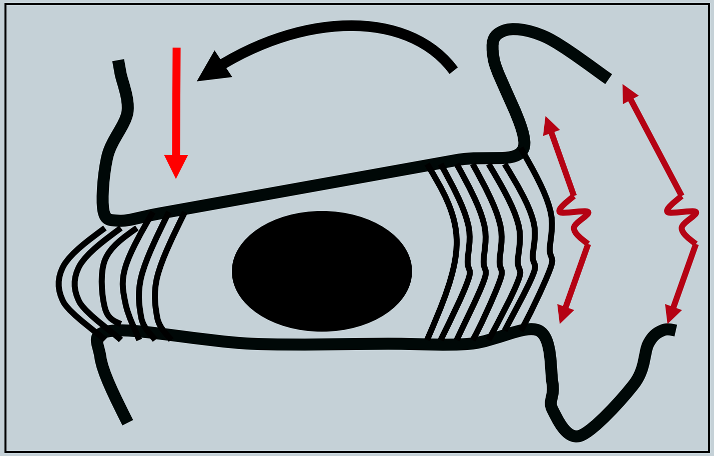
- Most common presentation
- Repetitive Flexion strain / might have had flexion injury
- Provocation: flexion and flexion/rotation activities and postures
- Reduction: lordotic/extended postures (lumbar roll/McKenzie ext)
- PE:
  - loss of segmental lordosis into flexion (sitting, standing, bending)
  - increased upper Lx lordosis / or total flexion
  - posterior pelvic tilt
  - segmental ‘drop’ into flexion (kyphosis) when forward bending
- Inability to independently (from Tx) anterior rotate & extend lower Lx - generate control from Tx
- (may be ‘stiff’ into extension – movement impairment)

Intervertebral disc





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Do cyclists with LBP commonly present with this FP LBP disorder?

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Manual Therapy 9 (2004) 211–219
MANUAL THERAPY
www.elsevier.com/locate/math

Original article

Spinal kinematics and trunk muscle activity in cyclists: a comparison between healthy controls and non-specific chronic low back pain subjects—a pilot investigation

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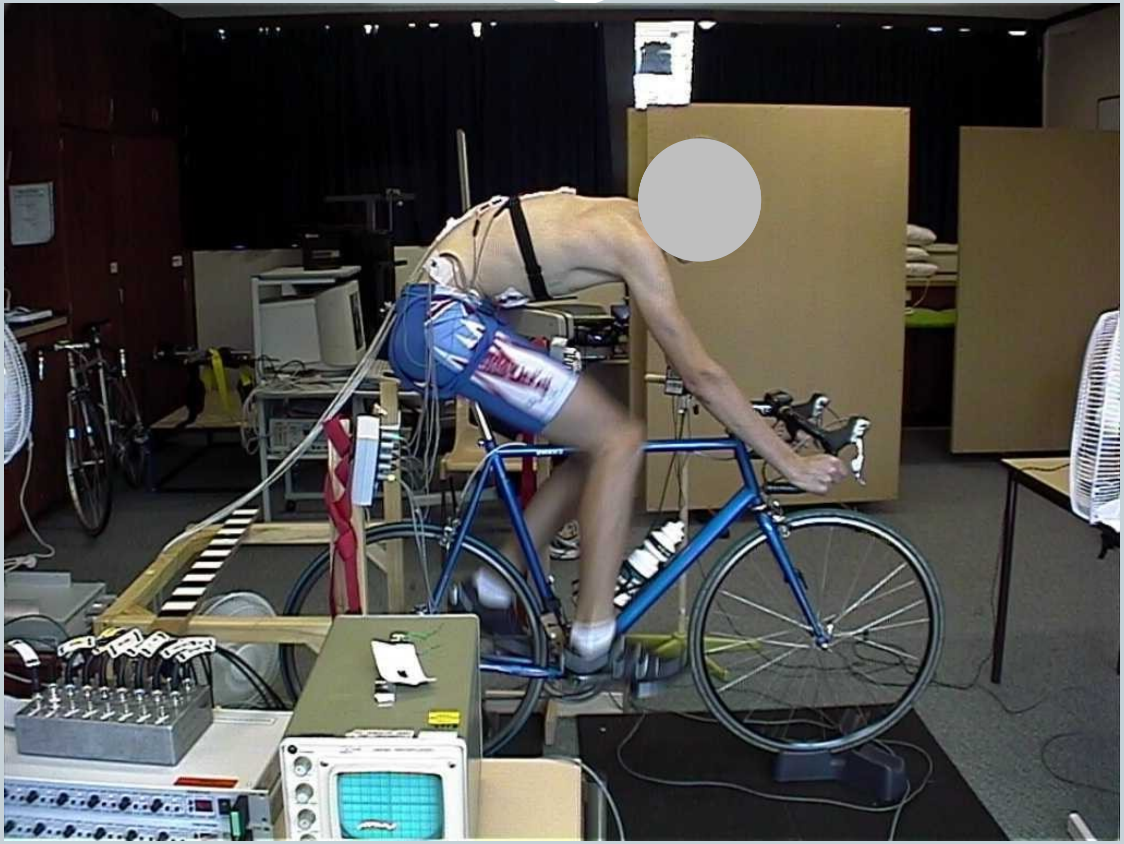
[b]*School of Physiotherapy, Curtin University of Technology, Western Australia, Australia*
[c]*Department of Rehabilitation Sciences and Physiotherapy, Ghent University, Ghent, Belgium*

Received 17 July 2003; received in revised form 31 March 2004; accepted 28 June 2004

[Burnett et al 2004]

Experimental set up



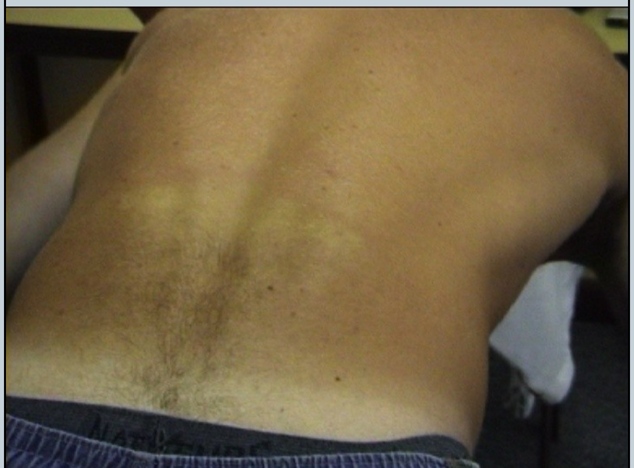
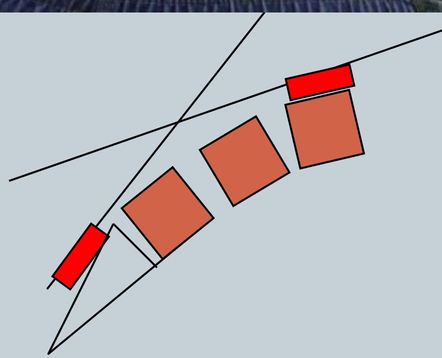
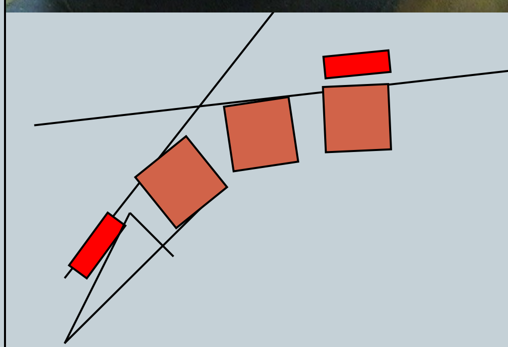
NSCLBP

@start no pain - cycling - till pain

Non-LBP matched subjects

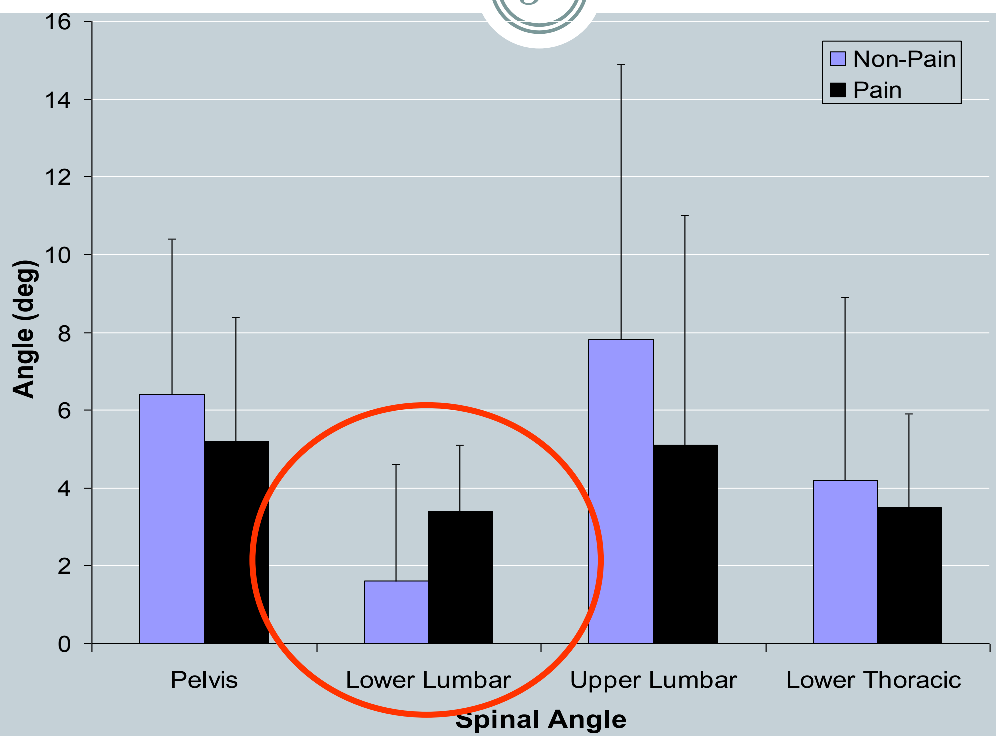
[Burnett et al 2004]

Results – LLx kinematics - Flexion (S2-L3)

	Non-LBP group	NSCLBP group
		
		
@start	25.1 º ±19.8º	38.6 º (±19.0 º)
@end	24.9 º ±20.2º	38.6 º (±19.9 º)

[Burnett et al 2004]

Results – LLx kinematics - Axial rotation (S2-L3)

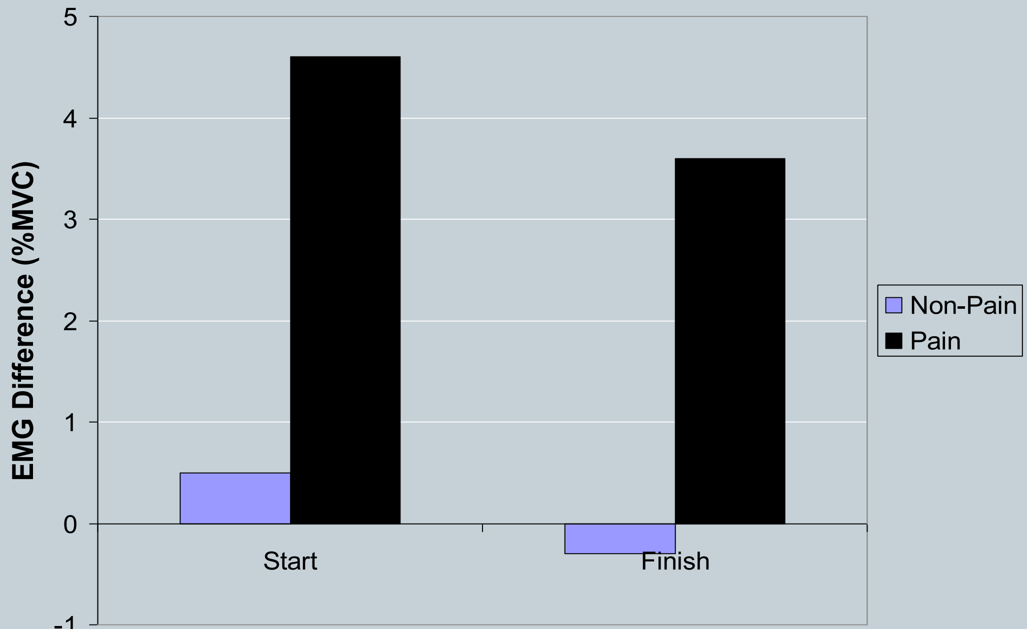


axial rotation @ LLx (end)

	Non-LBP		NSCLBP
@start	2.2 º ±0.9º		3.4 º (±1.8 º)
@end	1.6 º ±3.0º		3.4 º (±1.7 º)

[Burnett et al 2004]

Results – sEMG



difference L *vs.* R lumbar multifidus

	Non-LBP	NSCLBP
@start	0.5 º ±3.0º	4.6 º (±7.1 º)
@end	-0.3º ±2.2º	3.6 º (±5.7 º)

[Burnett et al 2004]

Conlusion

- NSCLBP (FP) cyclists demonstrated:
  - Increased flexion/rotation strain across the lower lumbar spine
  - Loss of LM co-contraction
  - Clinically linked with the development of LBP

[Burnett et al 2004]

Difference in LLx kinematics during cycling?

Manual Therapy 17 (2012) 312–317

Contents lists available at SciVerse ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Comparing lower lumbar kinematics in cyclists with low back pain (flexion pattern) versus asymptomatic controls – field study using a wireless posture monitoring system

Wannes Van Hoof[a,*], Koen Volkaerts[a], Kieran O'Sullivan[b], Sabine Verschueren[a], Wim Dankaerts[a]

[a] Musculoskeletal Research Unit, Department of Rehabilitation Sciences, Faculty of Kinesiology and Rehabilitation sciences, Katholieke Universiteit Leuven, Tervuursevest 101, B-3001 Leuven, Belgium

[b] Department of Physiotherapy, Faculty of Education and Health Sciences, University of Limerick, Limerick, Ireland

[Van Hoof et al 2012]

Material & Methods (1)

- 8 NSCLBP (FP) subjects vs. 9 healthy controls
- Subjects performed a 2-h outdoor cycling task on a standard flat parcours on their personal race bike
- Heart rate between 60 and 70% of their age-predicted maximum throughout the cycling task

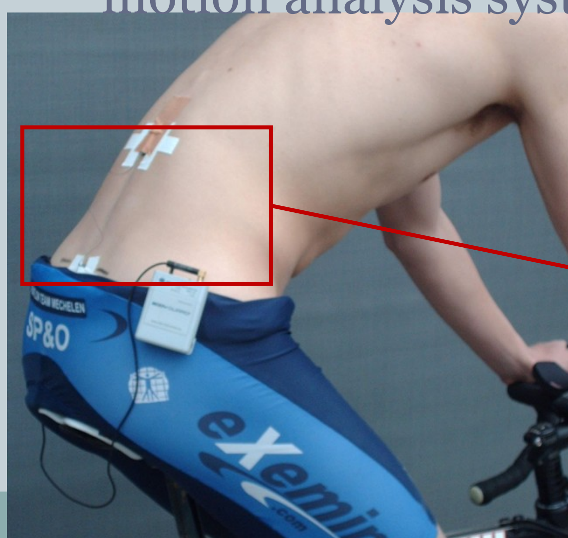
	Age (y)	Weight (kg)	Height (cm)	BMI (kg/m²)	Average pain (NPRS;0-10) 4w prior (cycling)	Average pain (NPRS;0-10) 4w prior (ADL)	Years of cycling	Saddle angle (°)
LBP (n=8)	28.3 (8.7)	76.2 (8.5)	184.9 (4.1)	22.3 (2.7)	5.6 (1.2)	3.3 (1.8)	7.3 (2.5)	-0.1* (2.9)
non-LBP (n=9)	28.4 (9)	75.1 (7.7)	181.2 (2.7)	22.8 (1.9)	0	0	8.4 (5.1)	2.2 (2.6)

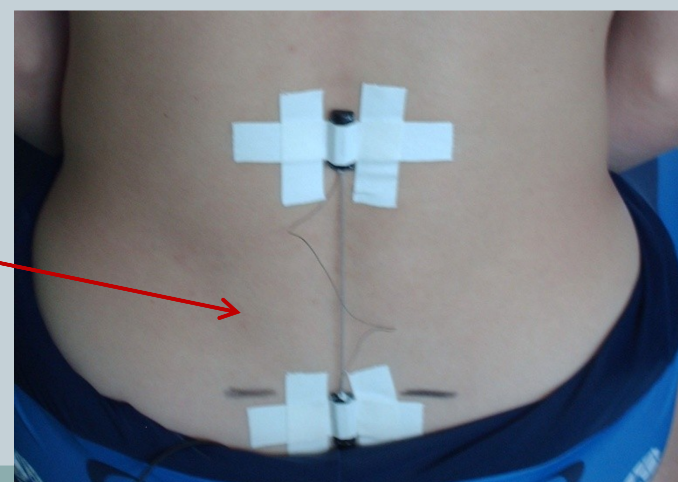
Baseline characteristics of both the NSCLBP(FP) and non-LBP group. Values are mean (±SD); BMI: Body Mass Index; NPRS: Numerical Pain Rating Scale; w: weeks; *negative value indicates the degrees above 90°; differences between group in age, weight, height or BMI were all p>0.05.

[Van Hoof et al 2012]

Material & Methods (2)

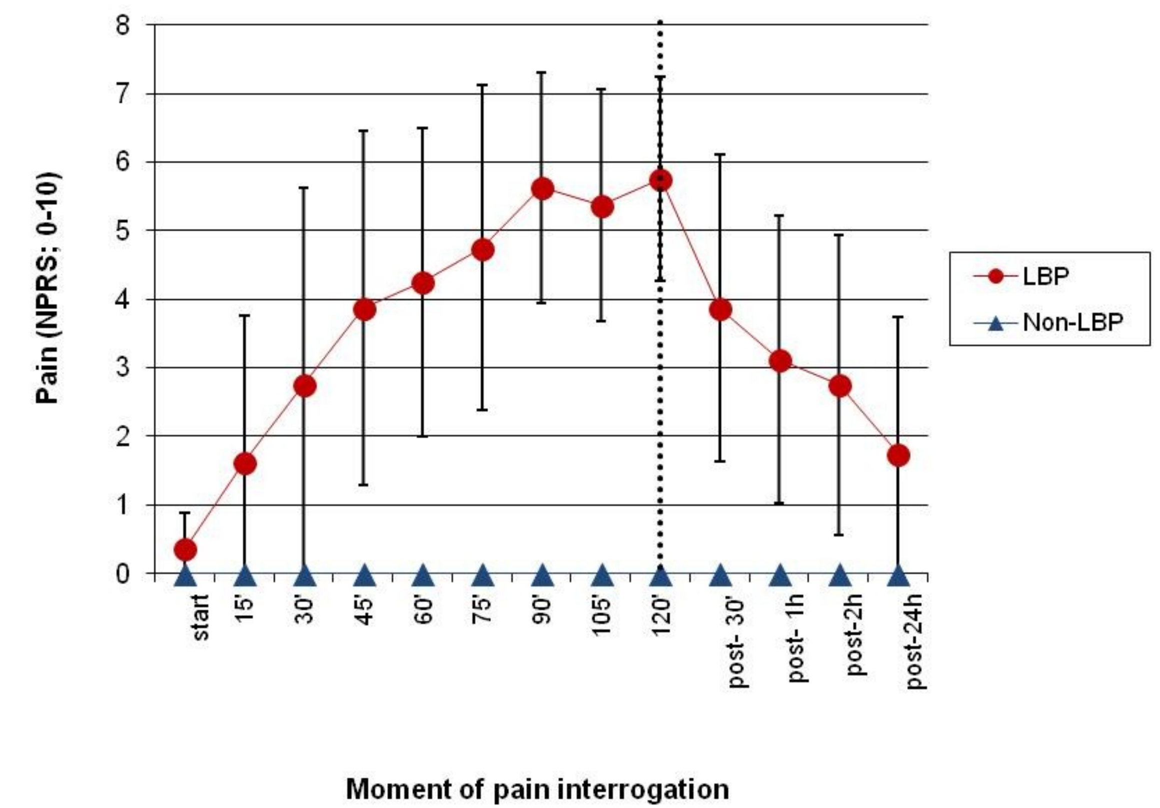
- Instrumentation
  - **The Bodyguard™** (BG) (Sels Instruments nv, Belgium)
    - The LLx kinematics was expressed as a % of total lumbo-pelvic flexion (% FL ROM).
      - Excellent intra- and inter-rater reliability [O'Sullivan et al. 2011]
        - ICC values: 0.837-0.874 and 0.914-0.940 respectively
      - Strong correlation (r=0.8) with laberatory laboratory-based motion analysis system (CODA) (Charnwood Dynamics Ltd, Leicestershire UK) [O'Sullivan et al. 2012]





[Van Hoof et al 2012]

Results (1)



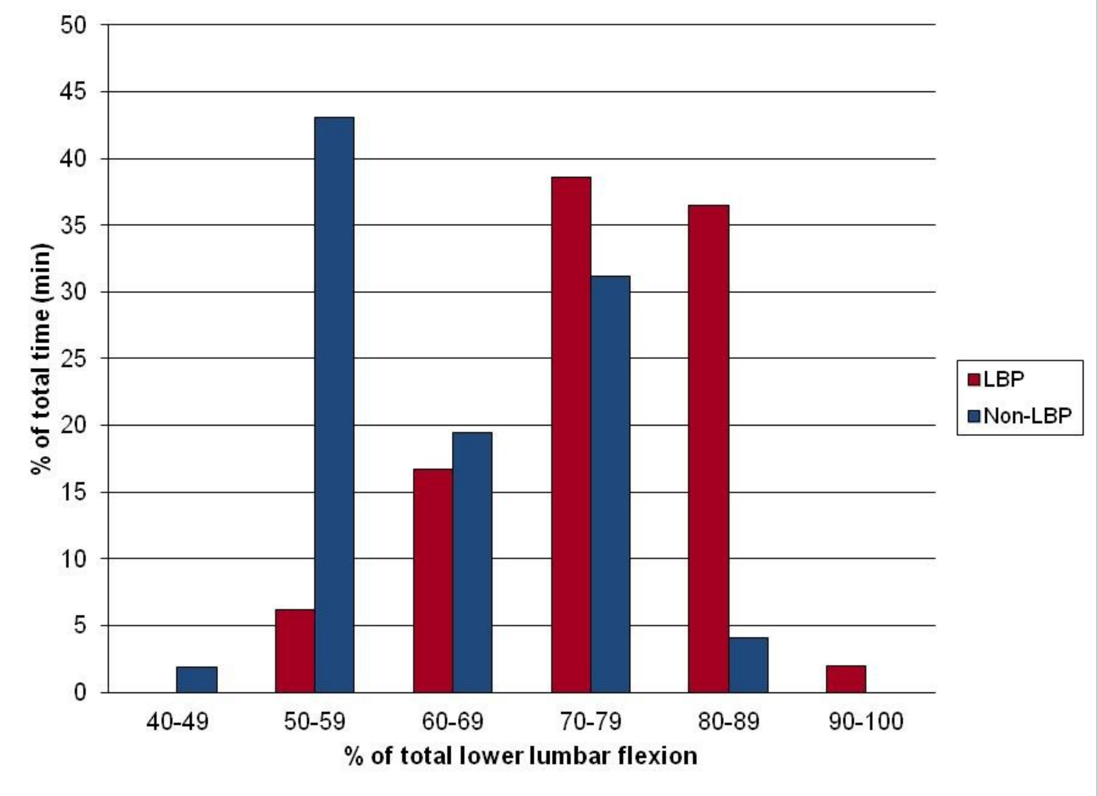
p < 0.001

The average pain scores (NPRS; 0-10) (±SD) during and after cycling per group. The vertical dotted black line indicates the end of the cycling task and the start of the 24h follow-up period. NPRS: Numerical Pain Rating Scale; LBP: low back pain; Non-LBP: no low back pain; h: hour.

[Van Hoof et al 2012]

Results (2)

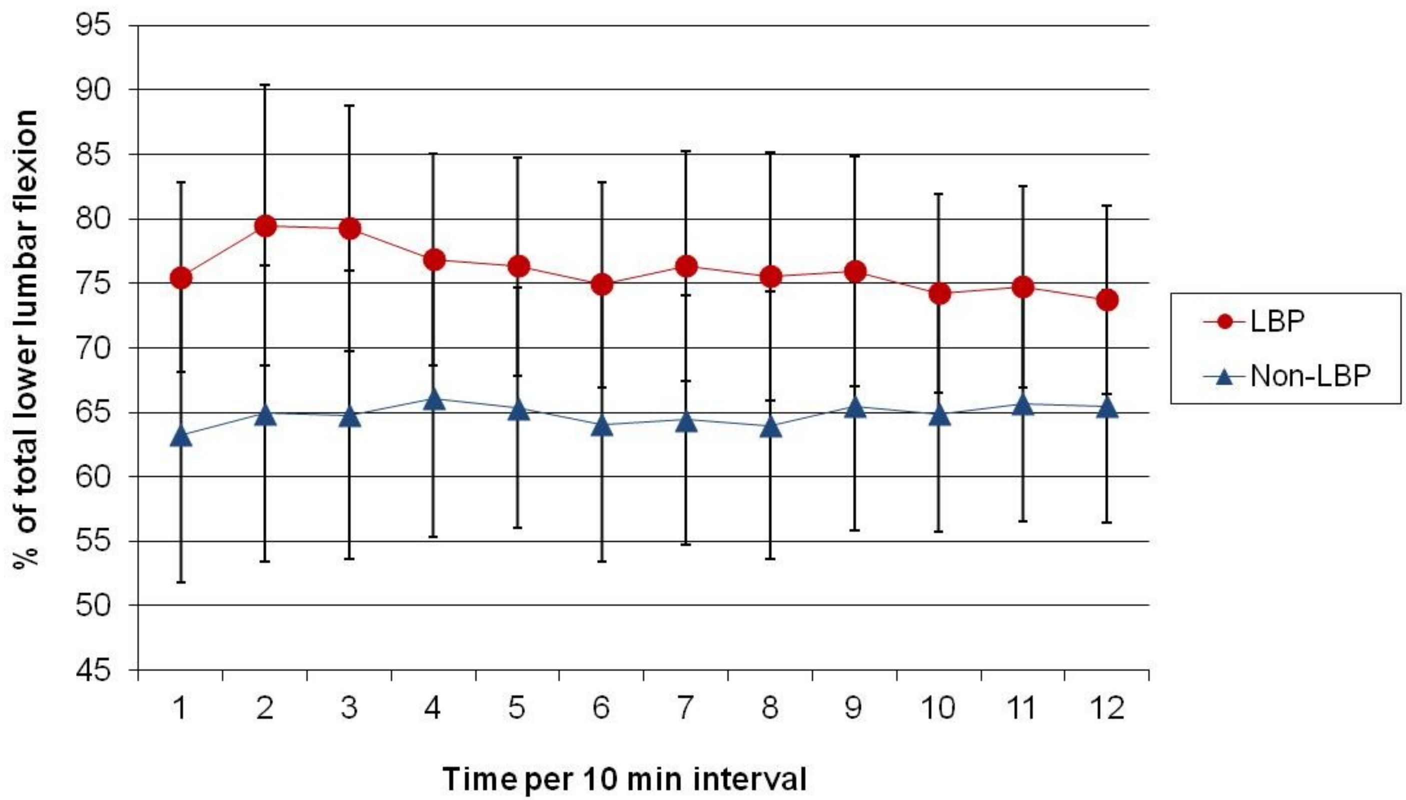
- The **mean percentage of total lower lumbar flexion** was significantly increased in the LBP group (**74.1**±7.9% Fl ROM) compared to the non-LBP group (**63.6**±9.8% Fl ROM) (p = 0.018).
- NSCLBP (FP) cyclists spend on average more than **38.5%** of their total cycling time in an end-range posture **exceeding 80% of total LLx flexion**, in contrast to only 4% for the non-LBP group.



Time (min) expressed as a % of the total two hours cycling period spent in the available lower lumbar flexion ROM (expressed as a % of the total lower lumbar flexion ROM). LBP: low back pain; Non-LBP: no low back pain.

[Van Hoof et al 2012]

Results (3)



Percentage of total lower lumbar flexion (±SD) over entire period per 12 intervals of ten minutes per group. LBP: low back pain; Non-LBP: no low back pain.

NSCLBP (FP) group exhibiting significantly greater LLx flexion (p = 0.035) remaining just significant when adding saddle angle as a covariate (p = 0.05)

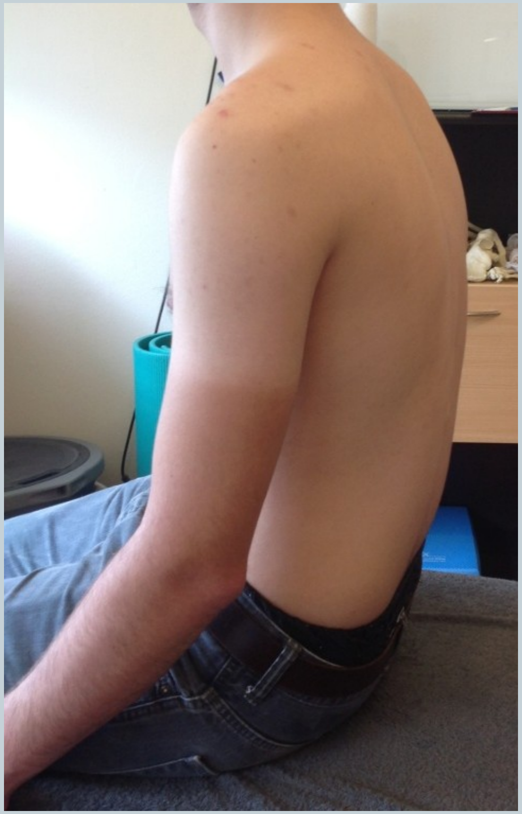
[Van Hoof et al 2012]

What is underlying cycling related NSCLBP?

Underlying mechanism?




Underlying mechanism?



How end range?

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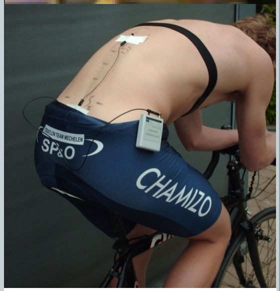
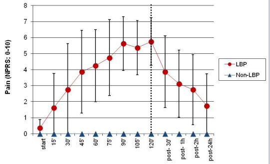
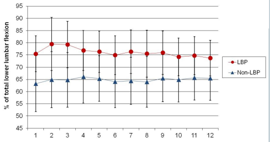
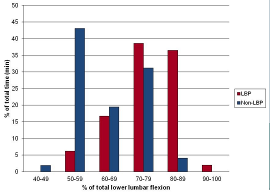
Underlying mechanism in cyclists with NSCLBP

- Inherent maladaptive motor control impairment at the lower lumbar spine
- Adopt and sustain an increased LLx flexion during cycling
- Maladaptive more flexed posture is maintained and associated with a significant increase of LBP
- Underscores previous findings in other sporting activities such as rowing









[Burnett et al 2004, Perich et al. 2006 , Van Hoof et al 2012]

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Etiology - pathomechanism

- Based on non-cycling biomechanical laboratory studies
  - Intersegmental forces transferred through the Fl/Rotated TxLx spine
  - Flexion-relaxation phenomenon
  - Mechanical-creep effect
  - Sustained forward flexion during cycling - increases the risk of tissue irritation or damage (disc ischemia)
  - (Excessive muscle activation - increased tissue strain across the lumbar spine)

O'Sullivan et al., 2006

[O'Sullivan et al., 2006; Sheeran et al., 2012; Dankaerts et al., 2006; Shirado et al., 1995, Srinivasen et al., 2007; Usabiaga et al., 1997; Brumagne et al., 2003; Garges et al., 2008; McGill and Cholewicki, 2001; Adams et al., 1995; Adams et al., 1994]

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Etiology - pathomechanism

- Based on non-cycling biomechanical laboratory studies

As a consequence of adopting and sustaining more end-range lower lumbar flexion during cycling, resulting from a maladaptive control impairment (e.g. FP), all these mechanisms can (individually or together) play an important role in the provocation of LBP during cycling through overloading the spinal structures

O'Sullivan et al., 2006

[O'Sullivan et al., 2006; Sheeran et al., 2012; Dankaerts et al., 2006; Shirado et al., 1995, Srinivasen et al., 2007; Usabiaga et al., 1997; Brumagne et al., 2003; Garges et al., 2008; McGill and Cholewicki, 2001; Adams et al., 1995; Adams et al., 1994]

How succesfully are we in managing cycling related LBP?

"Without identification of the underlying mechanism(s) the optimum treatment strategy for the patient's pain can not be selected…"

Woolf & Manion 1999

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Managing cycling related LBP

- LBP during cycling is related to maladaptive lower lumbar kinematics
- Trying to regain control over the lower lumbar region during cycling could be relevant in the rehabilitation/prevention of LBP in this subgroup

[Van Hoof et al 2011, 2012]

Managing LBP in cycling

Personal modifiable factors

Non-personal modifiable factors

[Van Hoof et al 2011, 2012]

Managing LBP in cycling

Personal modifiable factors

Non-personal modifiable factors

[Van Hoof et al 2011, 2012]

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Non-personal modifiable factors

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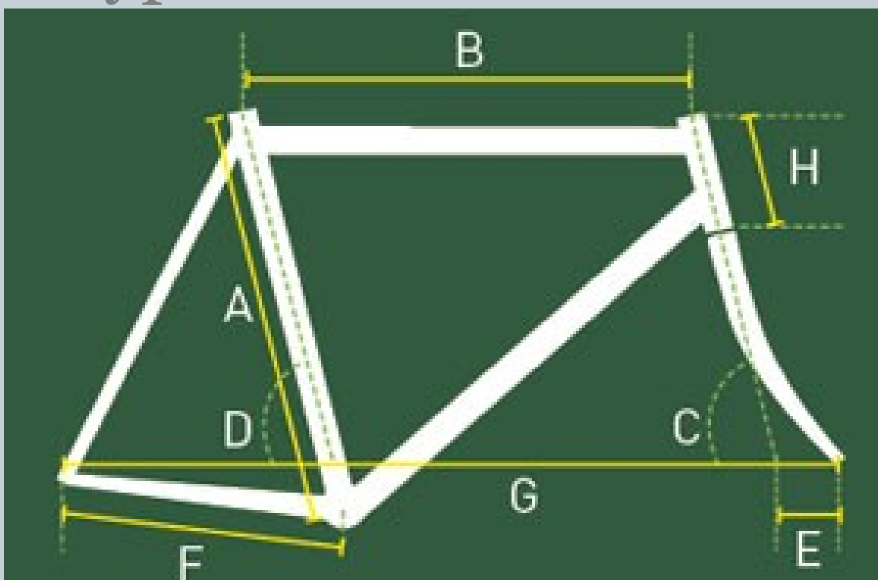
- Incorrect bicycle set-up
- Type of bike



- Positioning of hands on har
- Low gear usage

[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998; Muyor et al. 2011; Fanucci et al 2002]

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Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle
- Saddle height
- Reach
- Pedal unit position
- Positioning of hands o
- Low gear usage



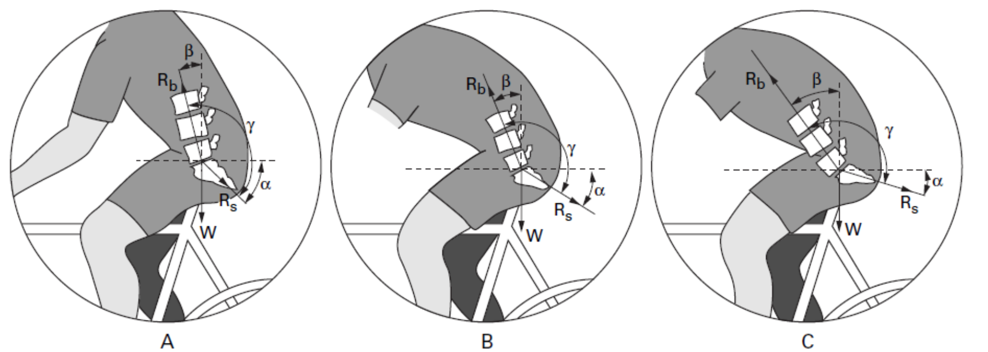


Figure 1 *Lateral pelvic/spine schema drawn from radiographs taken while the subject was sitting on various bicycles with various body positions, showing the related force vectors at the promontorium. W, weight; R_b, lumbar vector; R_s, pelvic vector; α, angle between ground and R_s vector; β, angle between weight axis and R_b vector; γ, lumbosacral/pelvic angle. (A) Town bike; (B) mountain bike; (C) racing bike.*

[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle
- Saddle height
- Reach
- Pedal unit position
- Positioning of hands on handle
- Low gear usage

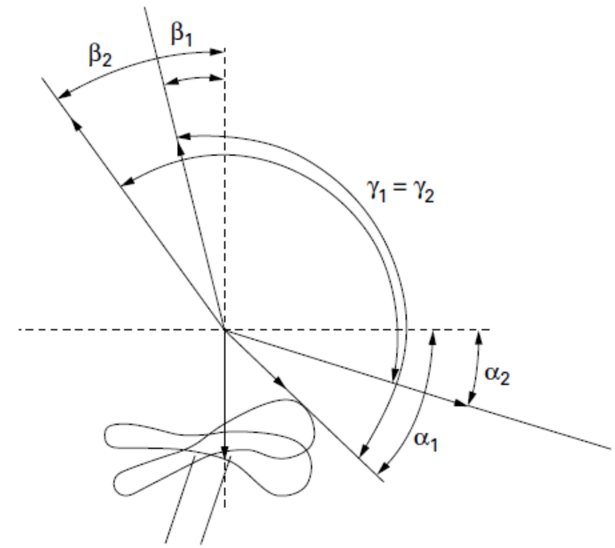


Figure 2 Changing the seat angle from horizontal to an anterior inclination causes the α angle to decrease ($\alpha_2 < \alpha_1$); the γ angle remains constant ($\gamma_1 = \gamma_2$) and the β angle increases ($\beta_2 > \beta_1$).

Table 1 Effect of α angle on the R_b to R_s ratio

α	R_b/R_s	R_s (W)	R_b (W)
0	1.22	1.43	1.74
10	1.39	1.24	1.72
20	1.64	1.00	1.64
30	2.05	0.74	1.52
40	2.96	0.45	1.33

α angle, the angle between the saddle and ground; R_b/R_s, tensile vectors acting on the promontorium: R_b, upward vector; R_s, downward vector.

[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle

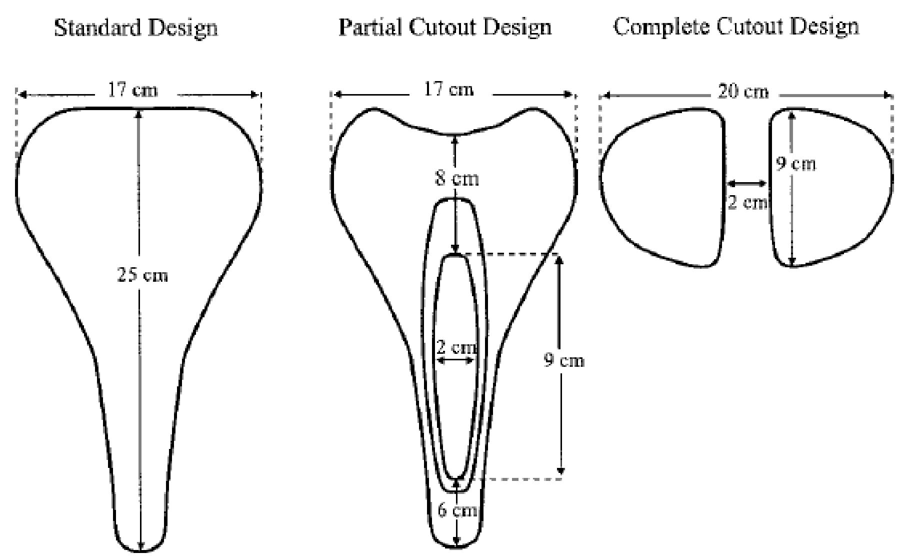
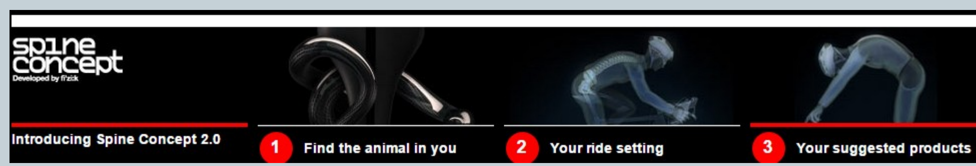


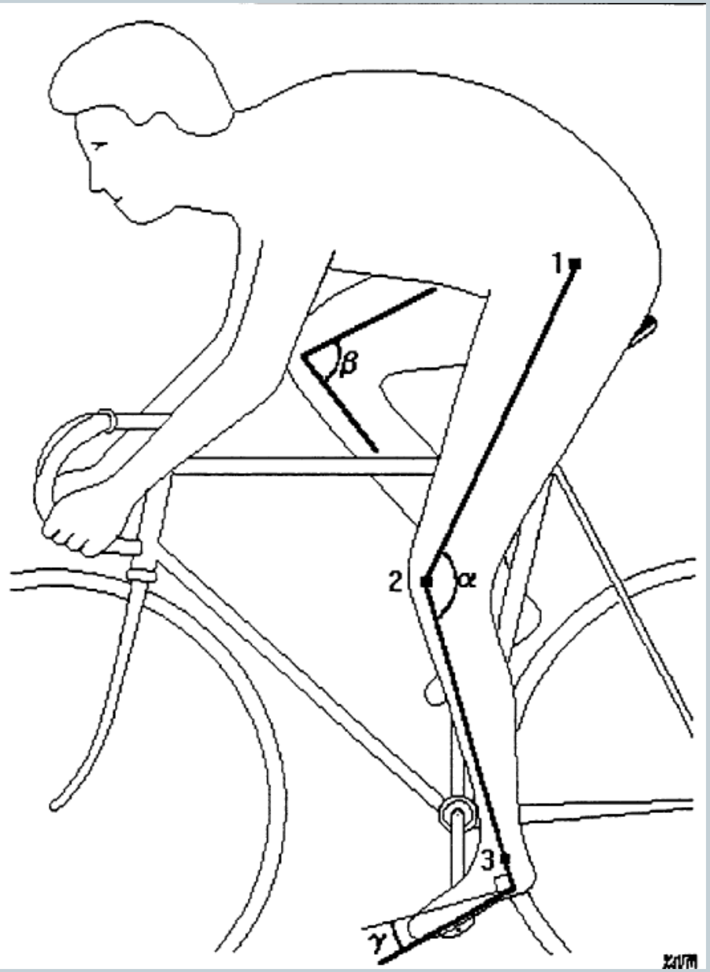
FIGURE 1—A top view of the three saddle designs and their physical dimensions.



[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

Non-personal modifiable factors

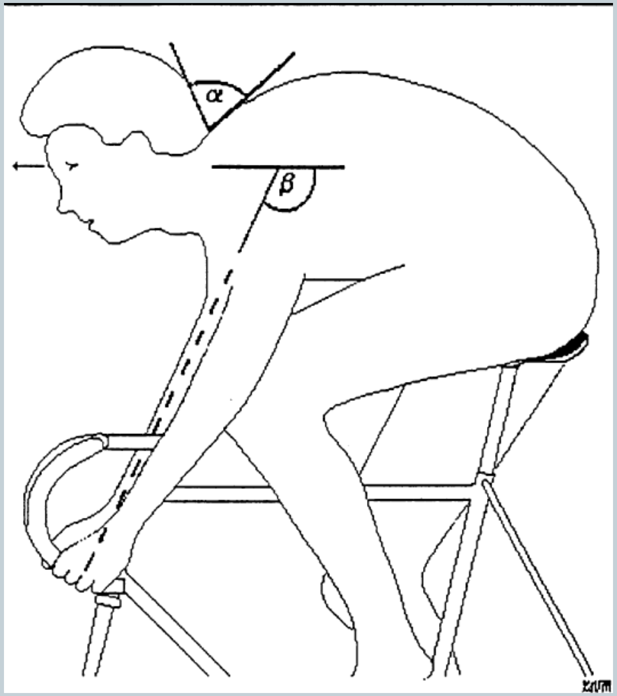
- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle
- Saddle height
- Reach
- Pedal unit position
- Positioning of hands on handleb
- Low gear usage



[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle
- Saddle height
- Reach
- Pedal unit position
- Positioning of hands on handlebars
- Low gear usage



[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
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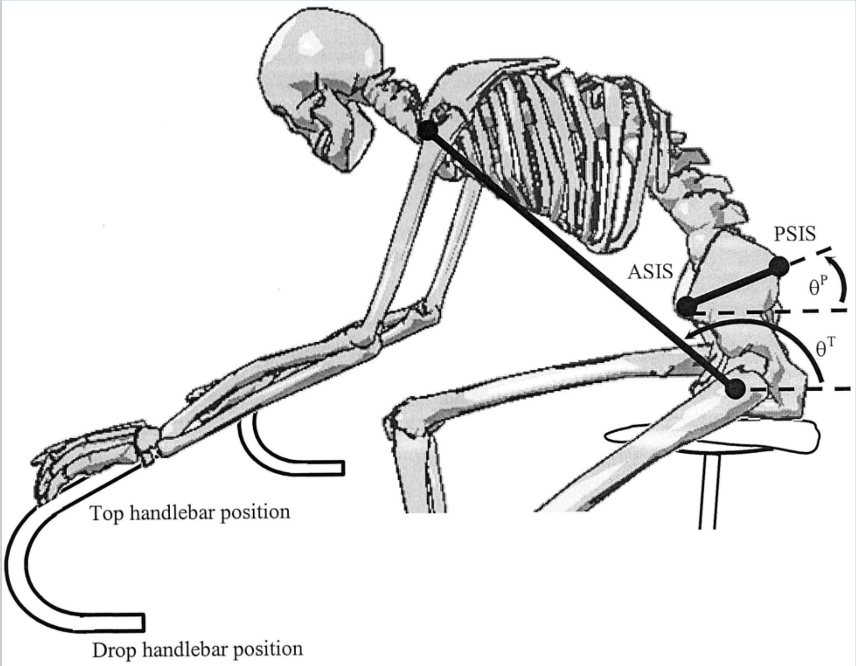

[Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

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Non-personal modifiable factors

- Proper frame size and bike set-up is important
- All these geometric bike related variables can have an influence on the LLx kinematics during cycling

Non-personal modifiable factors

- Proper frame size and bike set-up is important

BUT…
The way you posture yourself on the bike is at least equally important!

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It’s like a shoe…

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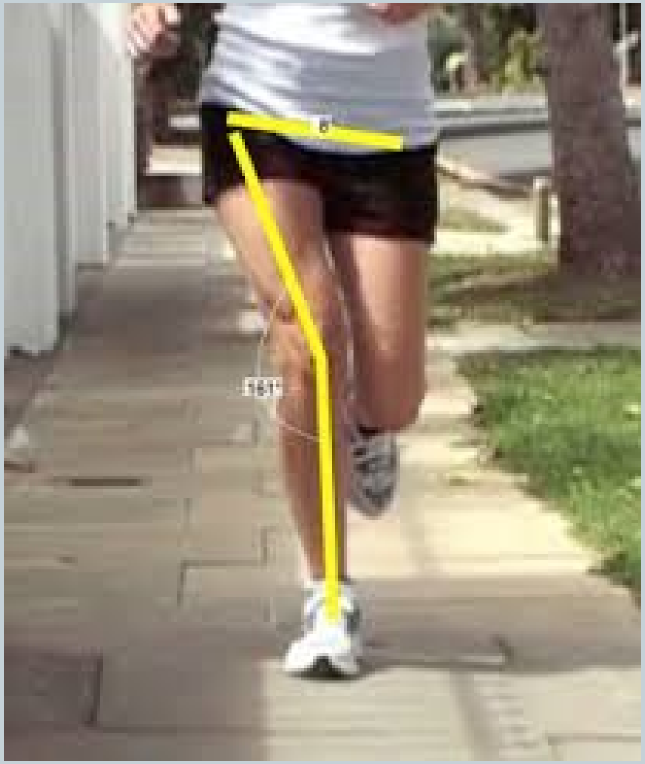
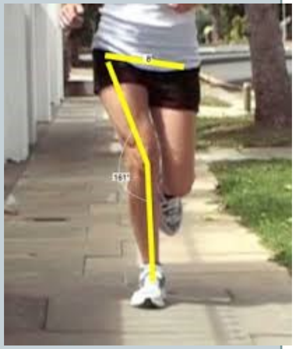
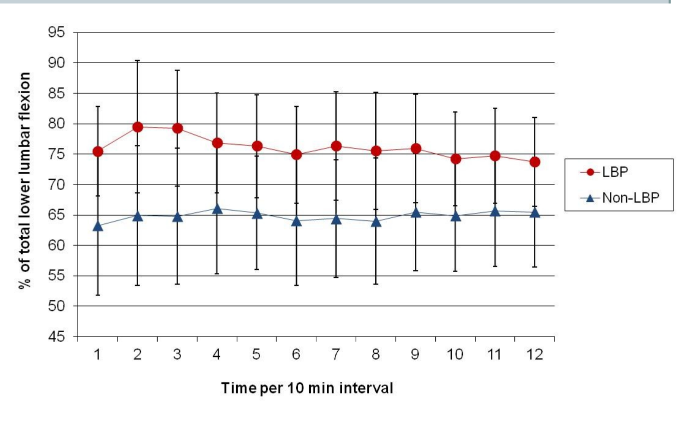


Don’t forget the personal factor!





e.g. posture- and movement behaviour

[Van Hoof et al 2011, 2012]

Managing LBP in cycling

Personal modifiable factors

Non-personal modifiable factors

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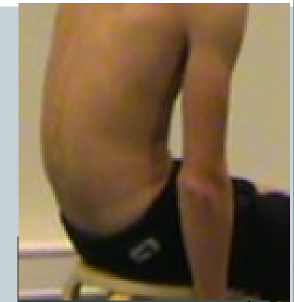
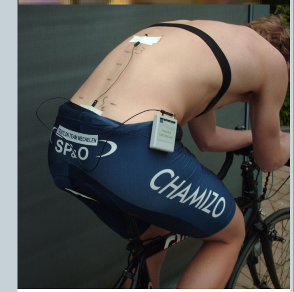
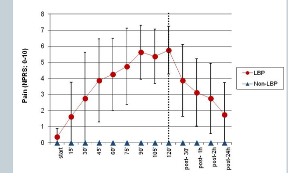
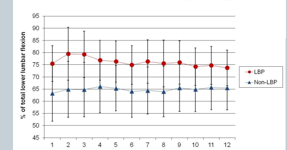
Personal Modifiable factors

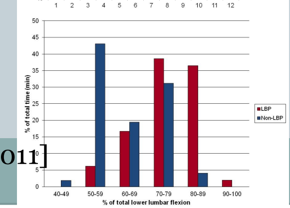
- Maladaptive motor control (FP) at the lower lumbar spine resulting in a more flexed lumbo-pelvic posture during cycling
- Lack of flexibility in the hamstrings
- Decreased back muscle endurance











[Williams et al. 1991, Gajdosik et al. 1992 & 1994, Burnett et al. 2004, O’Sullivan et al. 2005, Srinivasan et al. 2007, Van Hoof et al. 2011]

Managing cycling related LBP?

Personal modifiable factors

- Motor control impairment – FP
- Habitual sitting postures
- Lack of flexibility in the hamstrings
- Decreased back muscle endurance

Non-personal modifiable factors

- Incorrect bicycle set-up
- Type of bike
- Saddle angle
- Type of saddle
- Saddle height
- Reach
- Pedal unit position
- Positioning of hands on handlebars
- Low gear usage

[Williams et al. 1991; Burnett et al. 2004; Van Hoof et al. 2011; Gajdosik et al. ,1992 & 1994; Srinivasan et al. 2007 / Wilber et al. 1995; De Vey Mestdagh 1998; Salai et al. 1999, Bressel et al. 2003; De Vey Mestdagh 1998, Muyor et al. 2011, Fanucci et al 2002]

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Managing cycling related LBP

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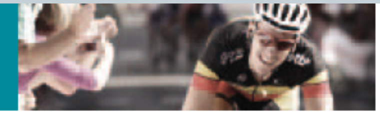
Need for considering combinations of personal and non-personal modifiable factors!

[Williams et a... Mestdagh
1998; Salai et...

How succesfully are we in managing cycling related LBP?

Managing cycling related LBP?

Sportmedische praktijk



Cognitive functional therapy intervention including biofeedback for LBP during cycling

A Single Case Study

W. Van Hoof, K. Volkaerts, K. O'Sullivan, S. Verschueren, W. Dankaerts

[Van Hoof W, Volkaerts K, O'Sullivan K, Verschueren S, Dankaerts W. Cognitive functional therapy intervention including biofeedback for LBP during cycling - a Single Case Study. Sport & Geneeskunde 2011; 44(4): 20-26.]

Cognitive Functional Therapy

- Alter the personal modifiable factor (maladaptive motor control)
- Specifically directed to regain motor control over the symptomatic LLx region and to facilitate a less end range flexed cycling posture
- Including biofeedback to monitor the lower lumbar kinematics
- Non-personal modifiable factors were unchanged

[Van Hoof et al. 2011]

Cognitive Functional Therapy: steps

1. **Cognitive component:**

   explaining the underlying mechanism behind the patient's LBP

2. **Motor control training:**

   regain motor control over his symptomatic lumbo-pelvic region

3. **Integration training:**

   individual exercises aiming to control anterior tilting of the pelvis in different positions (sitting and in four-point kneeling).

   Subject was asked to practice on a daily basis and to integrate the motor control strategies during ADL and cycling.

[Van Hoof et al. 2011]

Cognitive Functional Therapy: steps

1. **Cognitive component:**

   explaining the underlying mechanism behind the patient's LBP

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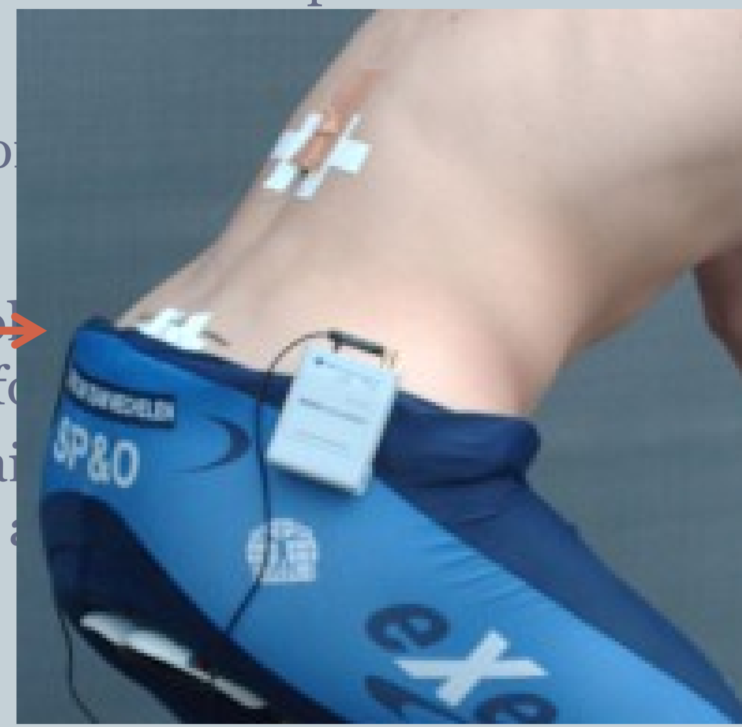
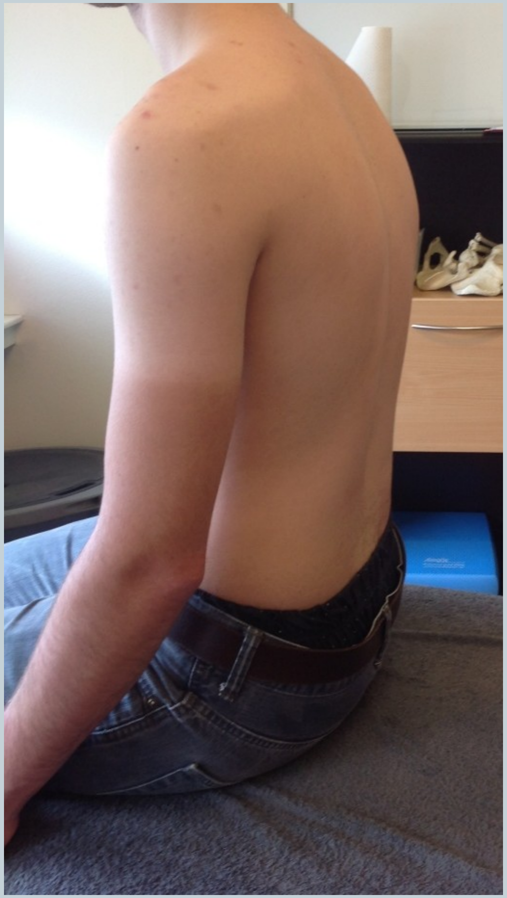
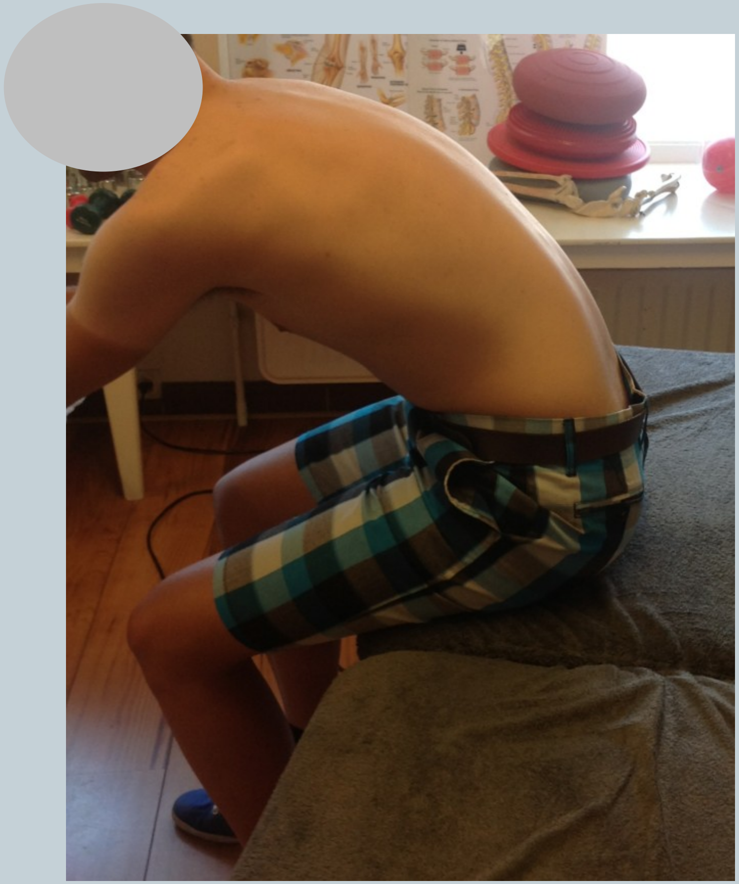


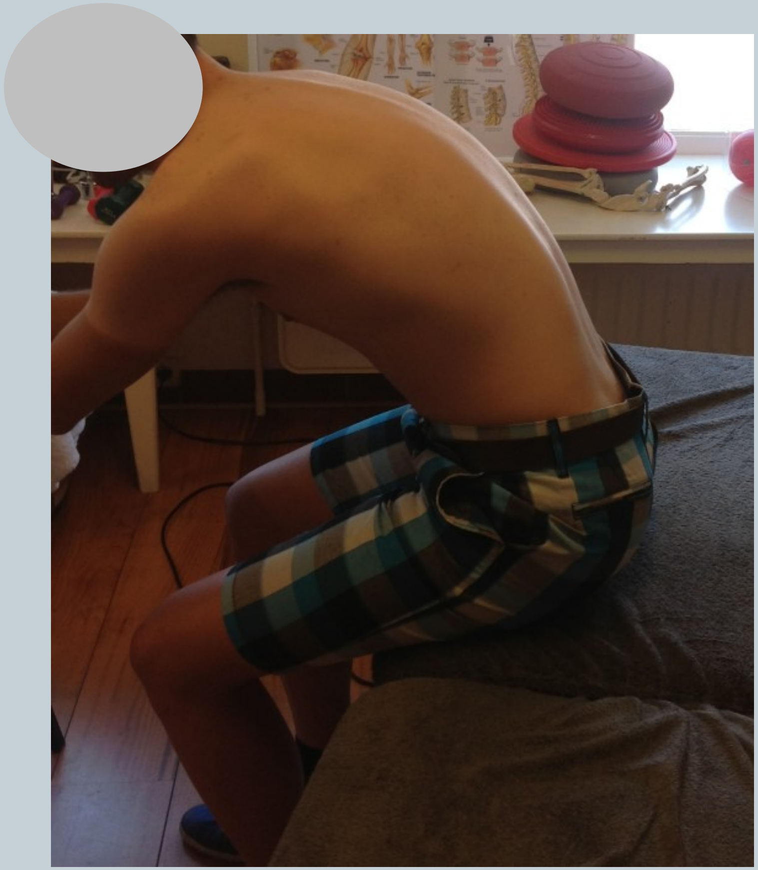
[Van Hoof et al. 2011]

Cognitive Functional Therapy

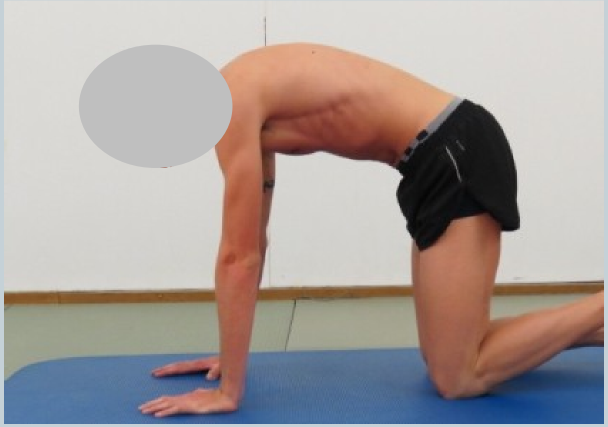


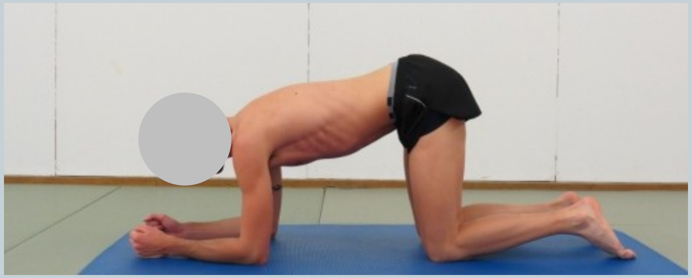
Cognitive Functional Therapy





Cognitive Functional Therapy

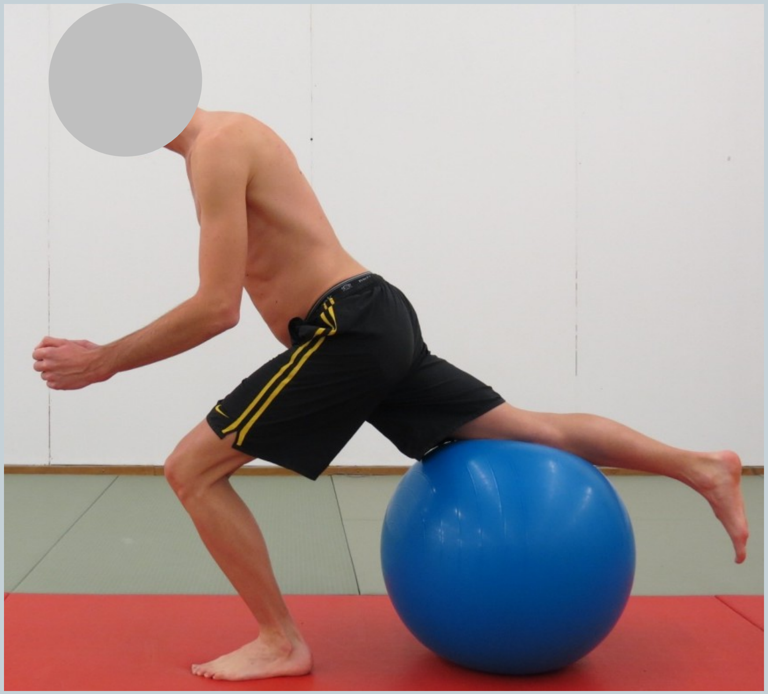




Cognitive Functional Therapy

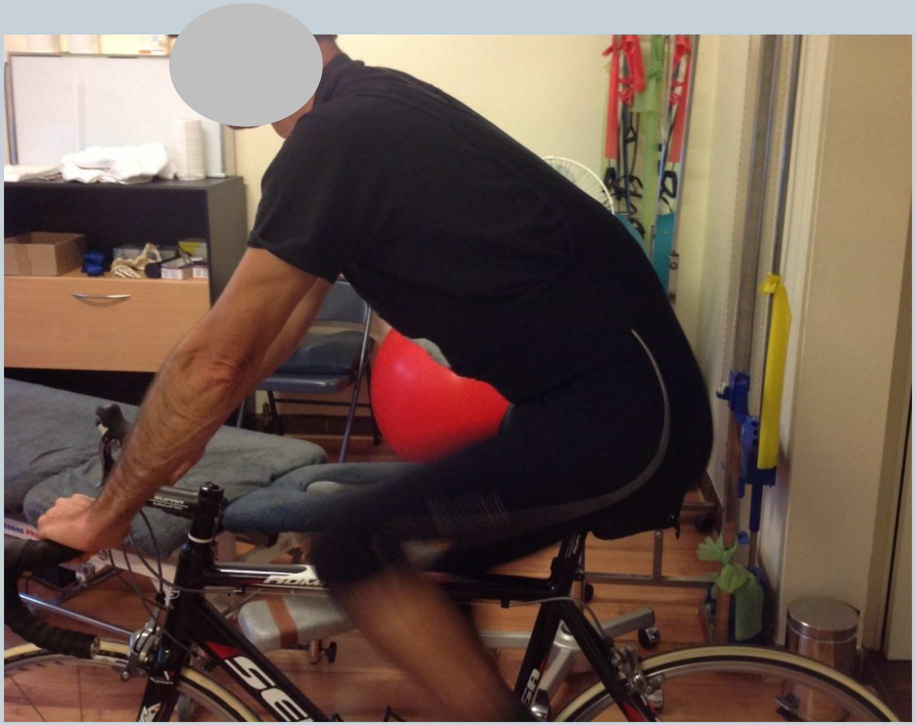
Cognitive Functional Therapy

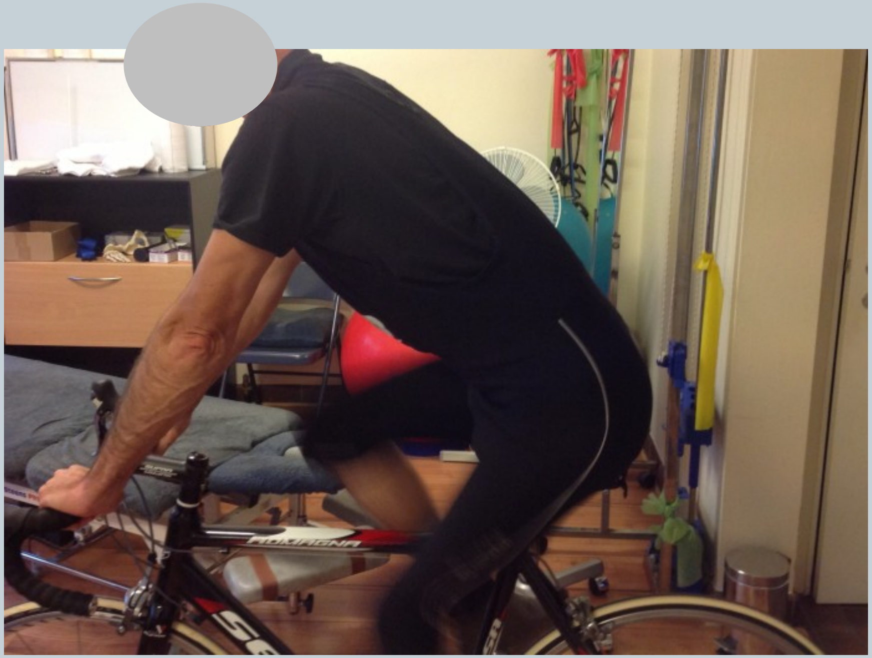
- Glutes!



Cognitive Functional Therapy

- Integration!





[Van Hoof et al. 2011]

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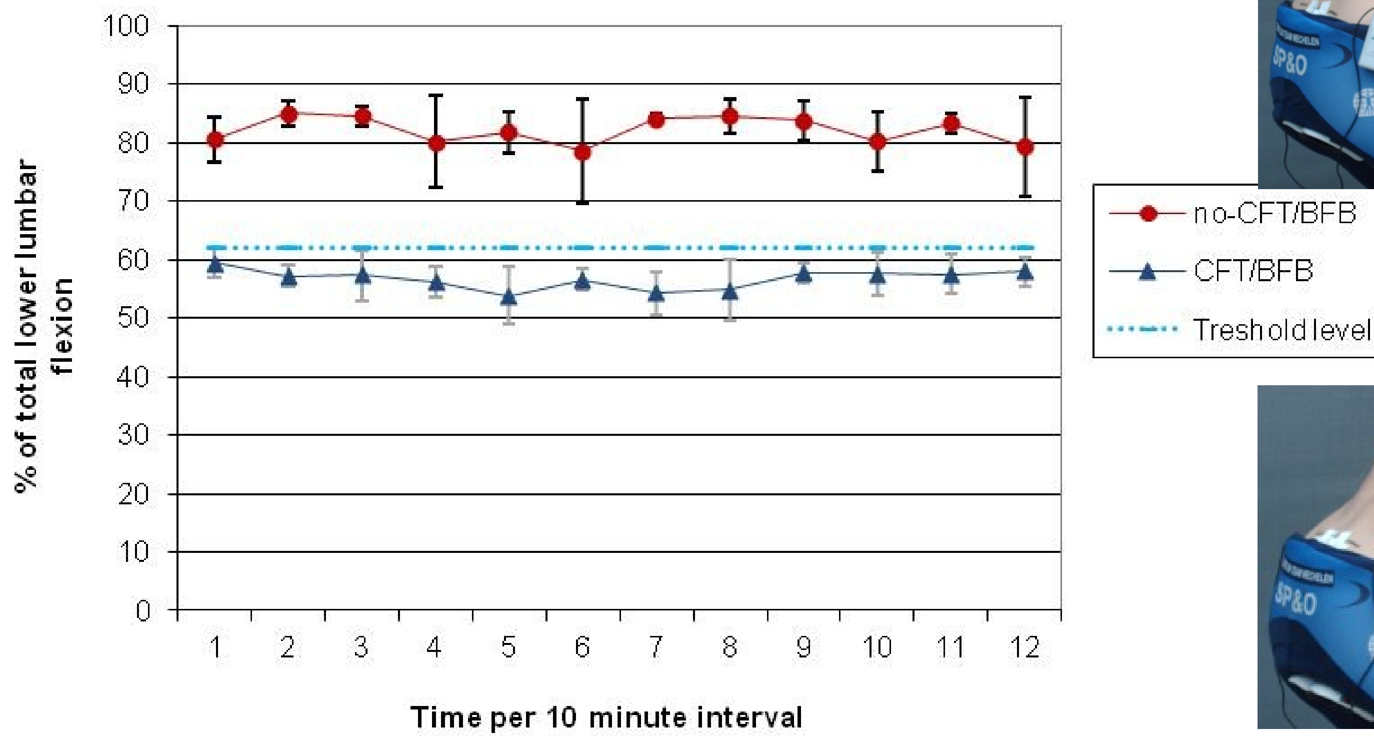
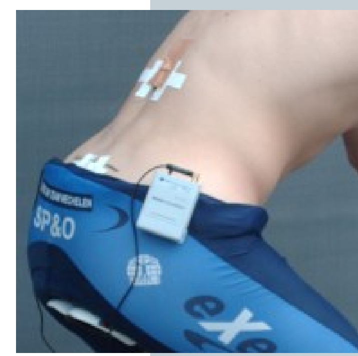
Cognitive Functional Therapy: results

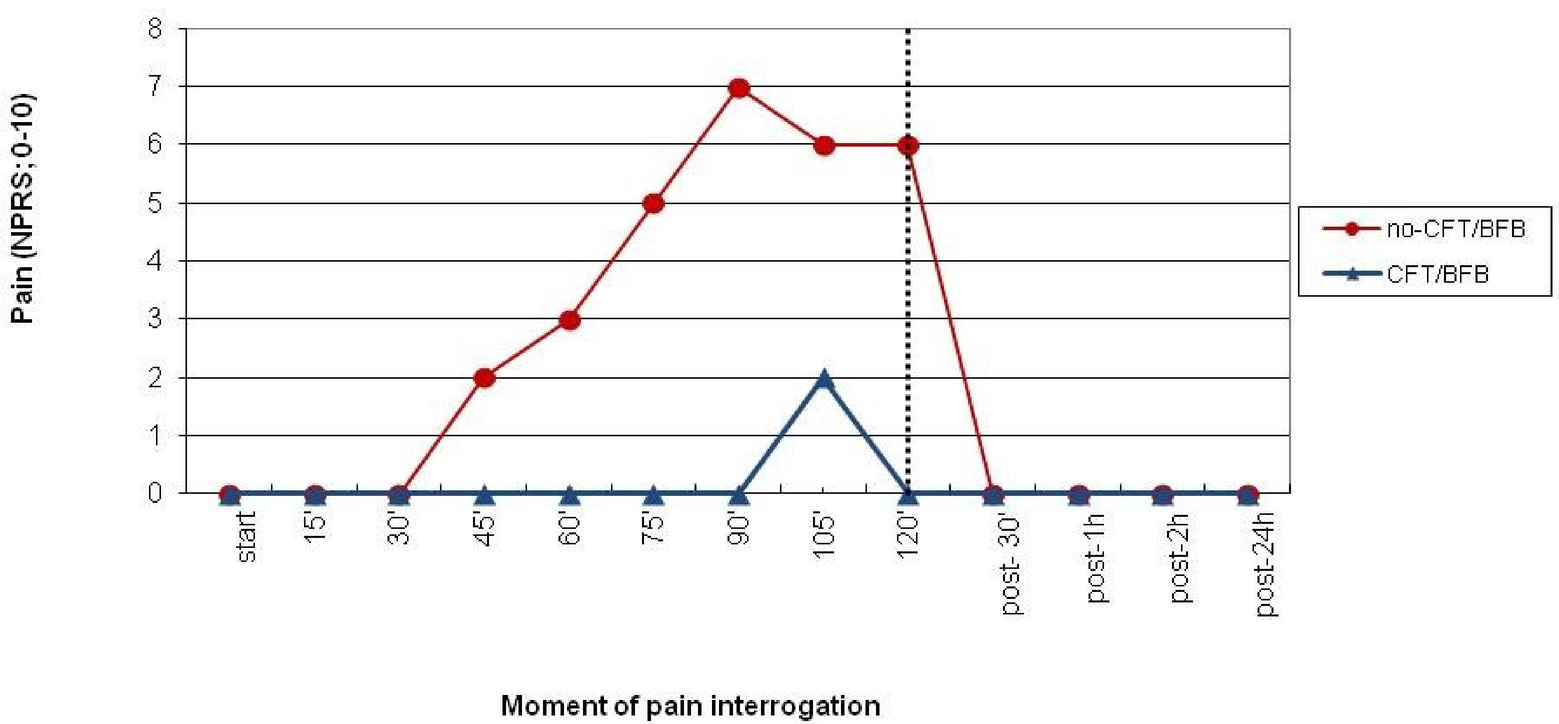




Percentage (±SD) of total lumbo-pelvic flexion (% Fl ROM) over entire period per 12 intervals of ten minutes of the LBP case subject provided with (CFT/BFB) and without CFT and BFB (no-CFT/BFB). SD: standard deviation, CFT: cognitive functional therapy, BFB: biofeedback.

[Van Hoof et al. 2011]

Cognitive Functional Therapy: results



The average pain scores (NPRS; 0-10) during and after cycling of the LBP case subject provided with (CFT/BFB) and without CFT and BFB (no-CFT/BFB). Significant difference over entire two hours of cycling ($p=0.01$). The vertical dotted black line indicates the end of the two hours cycling task and the start of the 24h follow-up period. NPRS: numerical pain rating scale, ʻ:minutes, h: hours.

[Van Hoof et al. 2011]

Cognitive Functional Therapy: conclusion

- The results revealed that an intervention targeting this maladaptive control at the symptomatic lower lumbar region resulted in:
  - a significant decrease of the near end-range lower lumbar flexion (upper figure).
  - a substantial reduction of LBP during cycling (lower figure).
- Additional studies are necessary to further test this interventional approach.

[Van Hoof et al. 2011]

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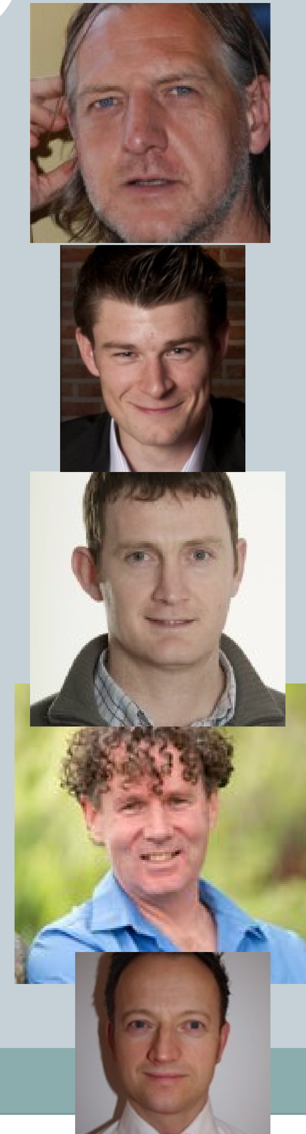
Team

PAIN-ED

- Wim Dankaerts
- Wannes Van Hoof
- Kieran O'Sullivan
- Peter O'Sullivan
- Kjartan Vibe Fersum



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Questions?