



Diagnosics of sacro-iliac joints

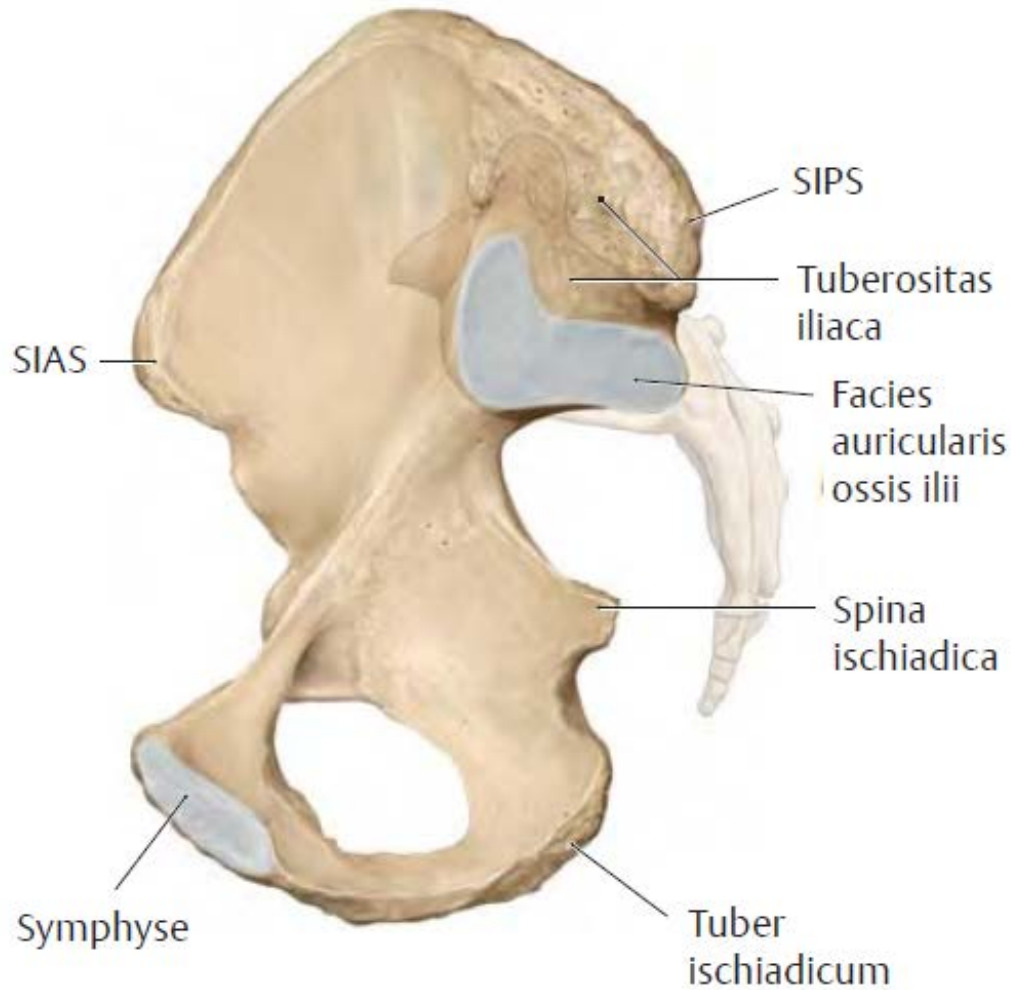
**According to recent kappa-
studies of DGMM-MWE**

Results

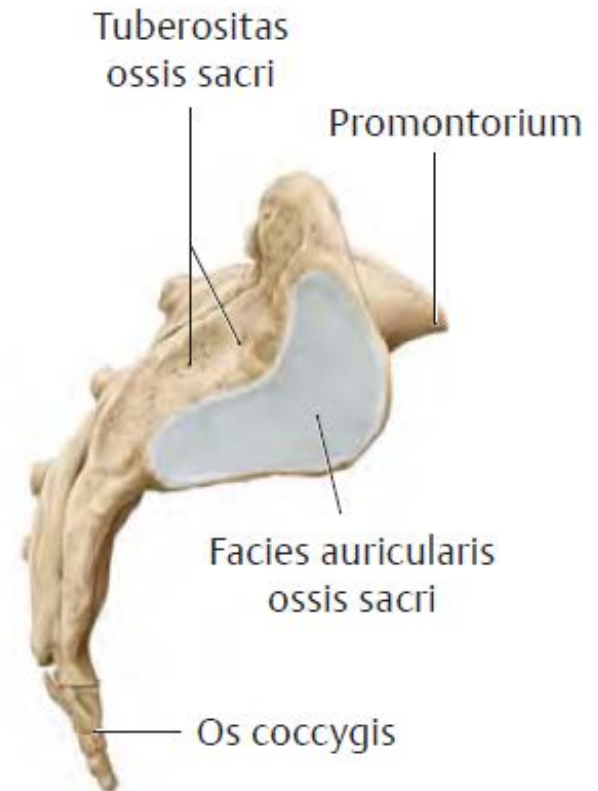
October 2018, Paris

Wolfgang von Heymann, MWE

SIJ: Amphi-Arthrosis

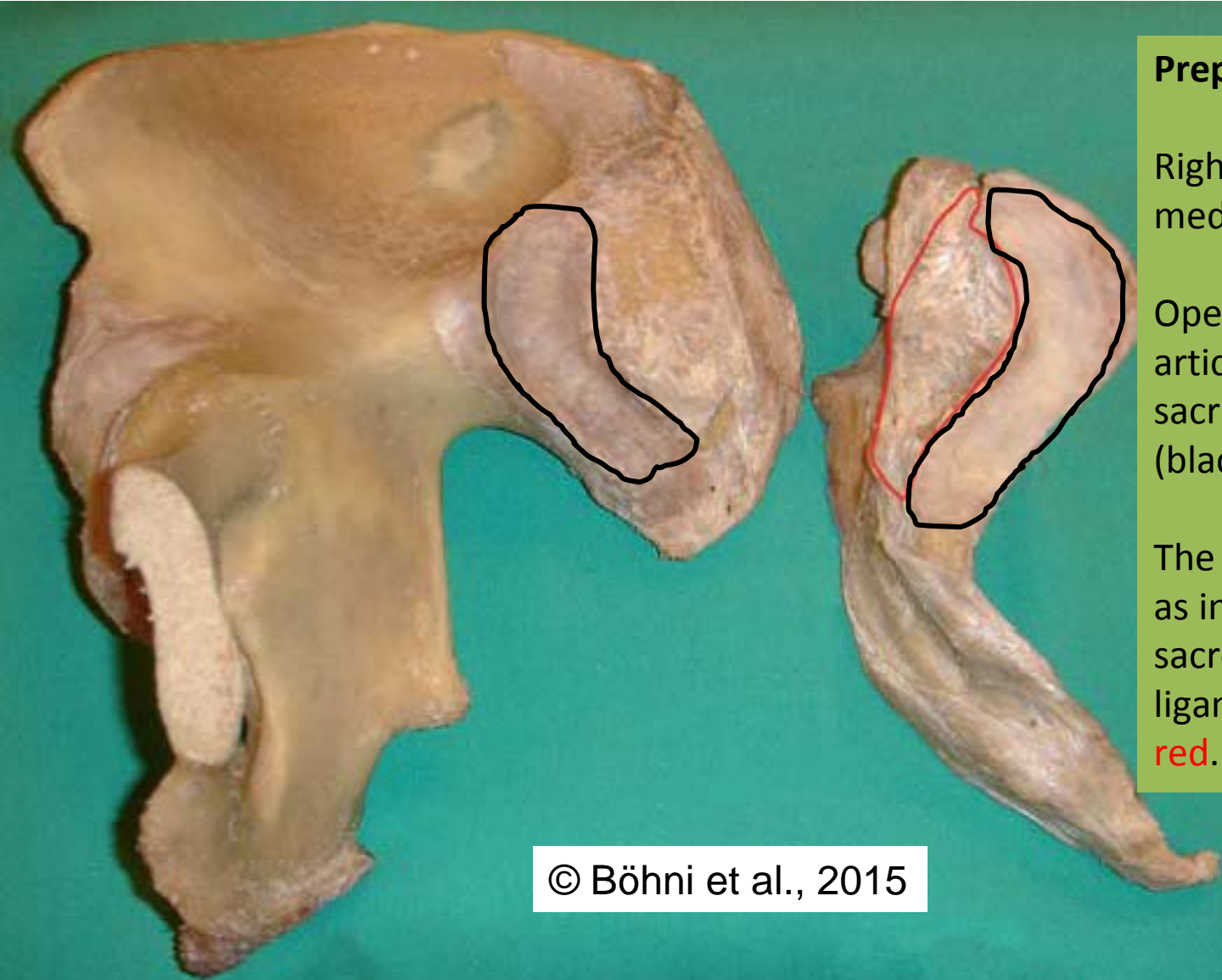


a



b

SIJ: Amphi-Arthrosis



Preparation of a right SIJ

Right ilium from left medial.

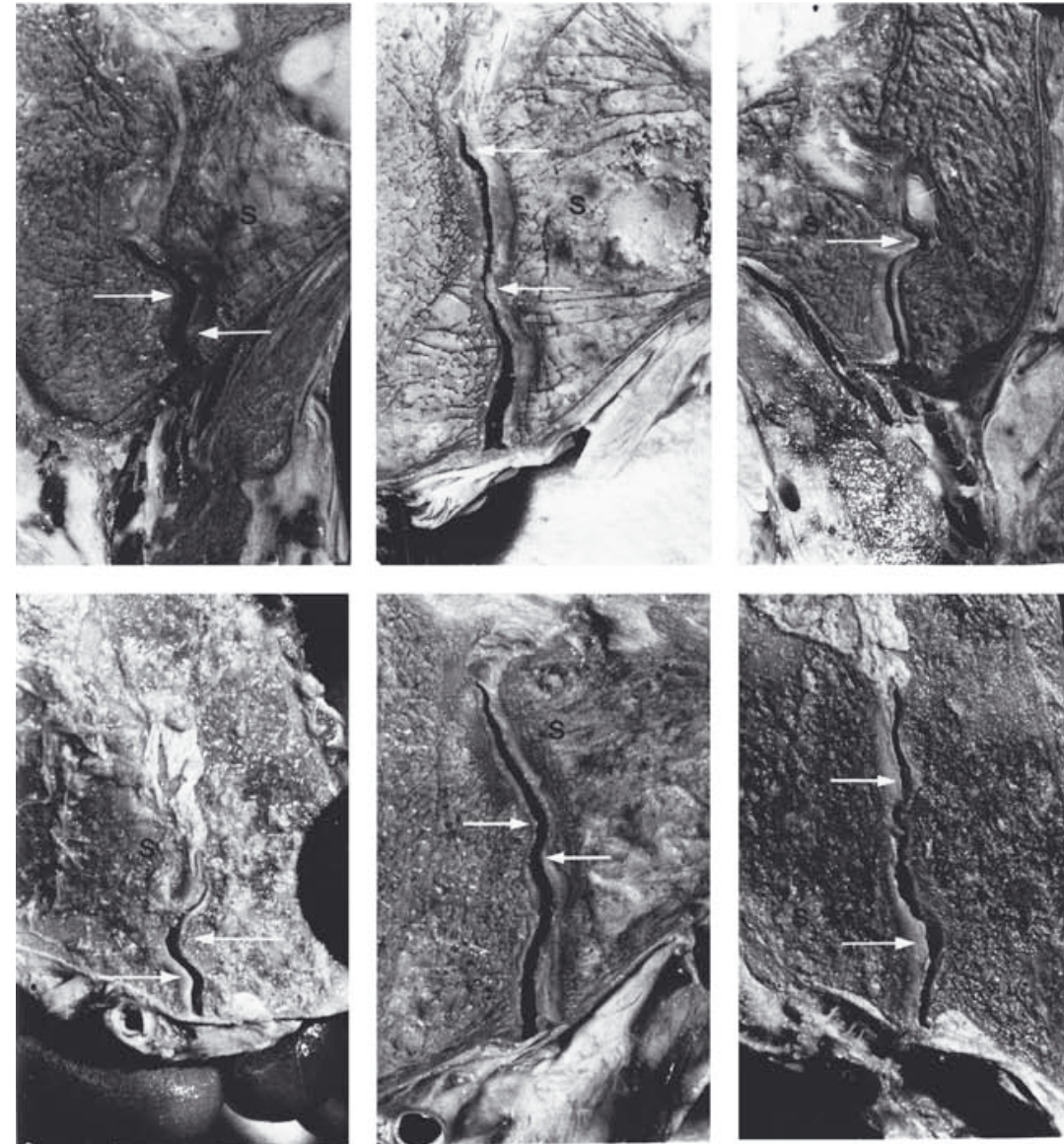
Opened: corresponding articular faces of the os sacrum from right medial (black).

The large tuberositas iliaca as insertion area of the sacroiliac interosseous ligaments is surrounded red.

© Böhni et al., 2015

SIJ: articular surface

There is a large variety of inter- and intra-individual articular surface
(Vleeming 2012)



The SIJ is:

- Anatomically and biomechanically not comparable to an intervertebral joint
- Phylogenetically composed out of the synostoses of 5 sacral vertebra with the attached plate for the lower extremities
- Capable to provide in-/reclining a nutation-counternutation mobility of 2 – 4°
- Highly sensitive to any loss of function
- Origin of the very frequent S1-pain syndrome with referred pain in the leg



SIJ: still a diagnostic challenge

- Important differential diagnosis to low back pain (LBP)
- In chronic LBP: „no lumbago without SIJ-dysfunction, no SIJ-pain without lumbar spine dysfunction“
- Hitherto there is no diagnostic or therapeutic method that is significantly superior to others (imaging, arthrography, injection, conservative or interventional procedure) (Simopoulos et al., 2012)
- The SIJ is an important reflex center to control the locomotor organ (chain reactions, atlas function, central cervical nucleus - CCN)



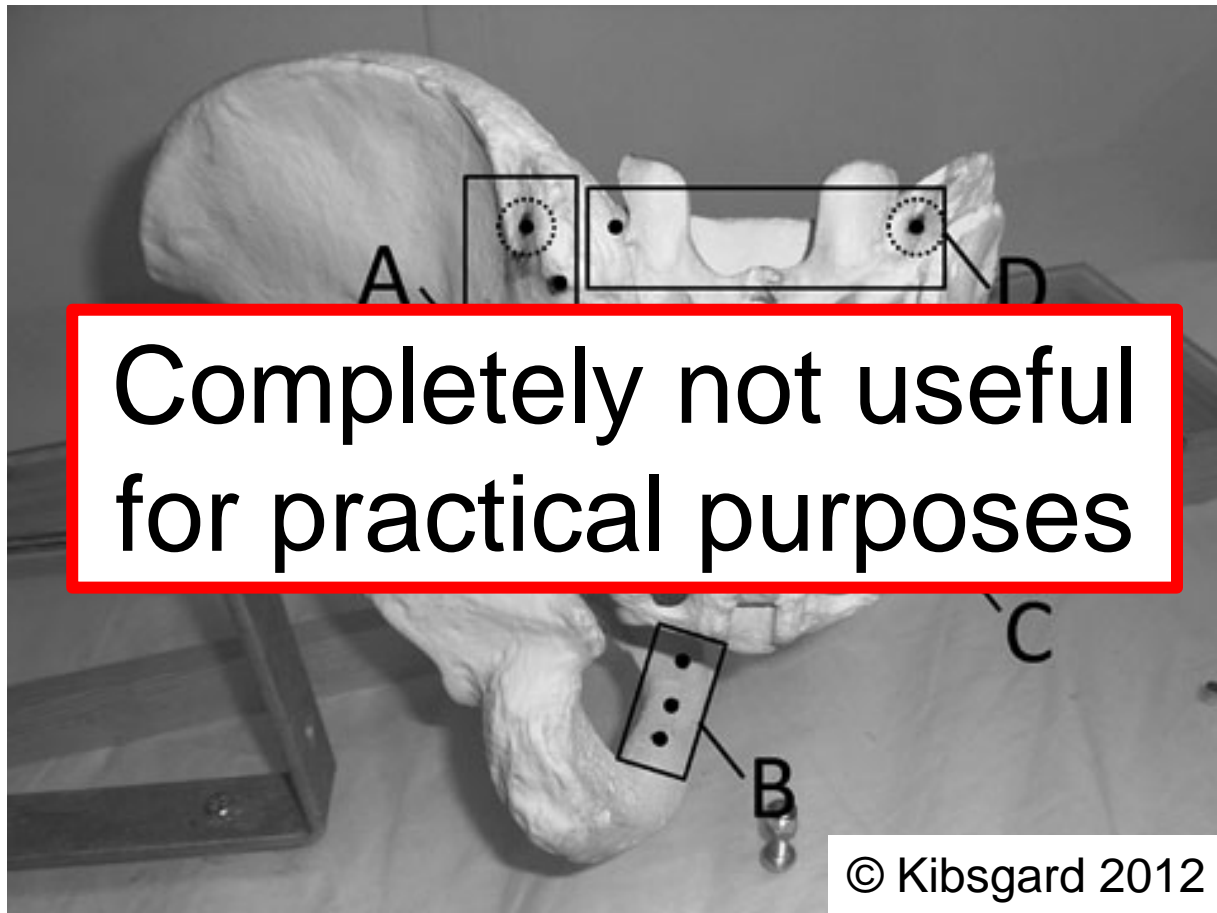
Sole reliable diagnostic: radio-stereometric analysis



© Stuesson, 2000



Sole reliable diagnostic: radio-stereometric analysis

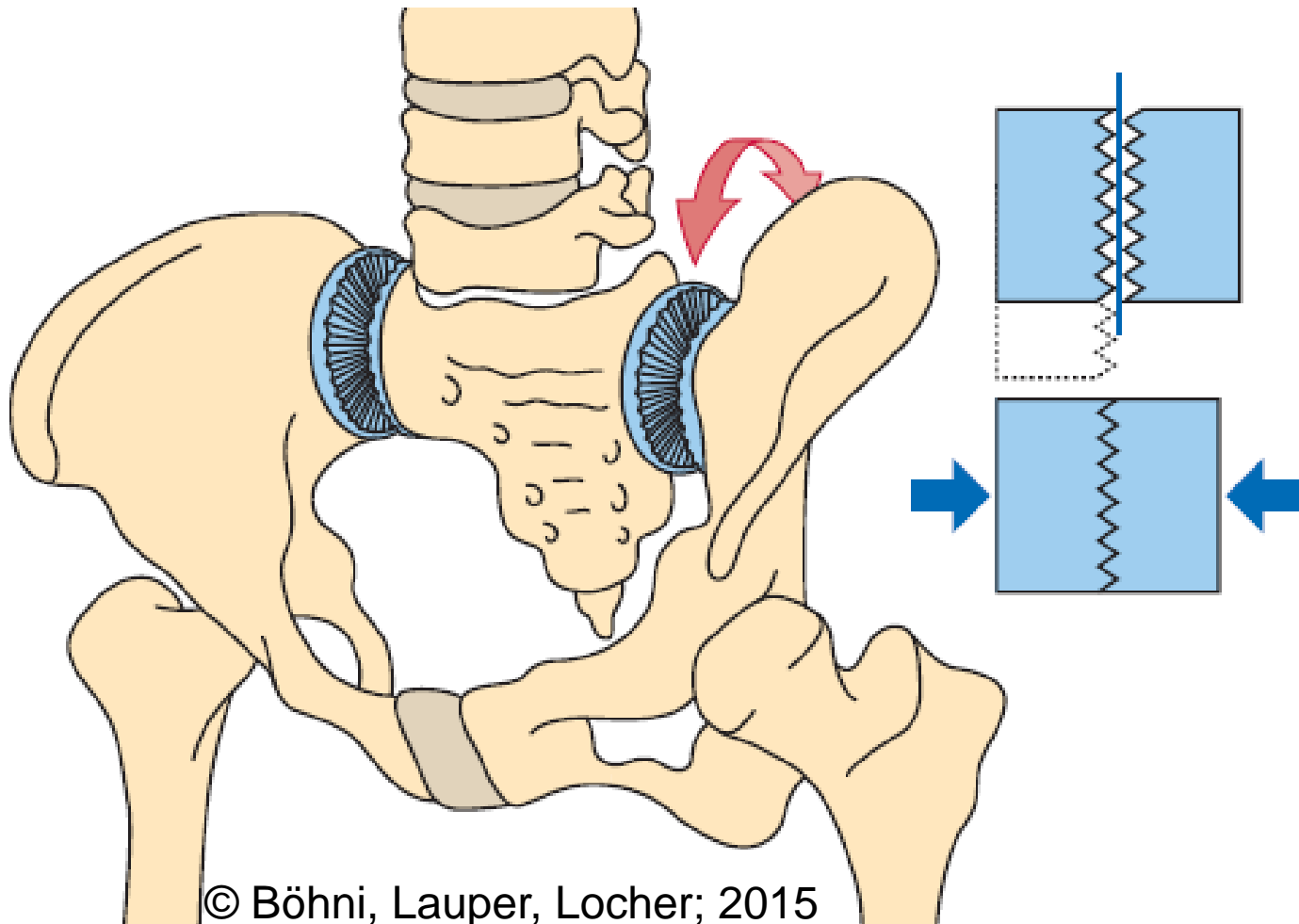


The diagnostics of SIJ seem to be difficult and uncertain

- There is no typical pain pattern, the innervation is described with contradictions
 - 1 Solonen et al, Acta Ortho Scand 1957; 27;1-127
 - 2 Grob et al, Z Rheumatol 1995; 54;117-122
 - 3 Fortin et al, Am J Orthop 1999; 12:687-690
 - 4 Ikeda et al, J Nippon Med Sch 1991; 58:587-96
 - 5 Fortin et al, Pain Physician 2003; 6:269-71
- There is no gold standard in SIJ diagnostics
 - Even Rx-guided intraarticular injections do not have reliable results ! (Fortin et al., 1994)
- Many irritation-zones/points are described in literature
- The clinical examination of function is not always easy, reliable and reproducible



The form of the articular surfaces ensures excellent connection stiffness through its positive locking-together under condition of gravity (high friction): standing/walking



© Böhni, Lauper, Locher; 2015

What makes the diagnostics so complicated?

There is no typical pain pattern

Innervation

- from different segments: L2-S2 ⁽¹⁾
- Innervation only from dorsal branches ⁽²⁾
- anterior and posterior part may have different innervation ^(3, 4)
- possible connections exist on the dorsal side between the posterior sacral foramens and L5, as well as connections on the ventral side to the lumbosacral plexus ⁽⁵⁾

1 Solonen et al, Acta Ortho Scand 1957; 27;1-127

2 Grob et al, Z Rheumatol 1995; 54;117-122

3 Fortin et al, Am J Orthop 1999; 12:687-690

4 Ikeda et al, J Nippon Med Sch 1991; 58:587-96

5 Fortin et al, Pain Physician 2003; 6:269-71



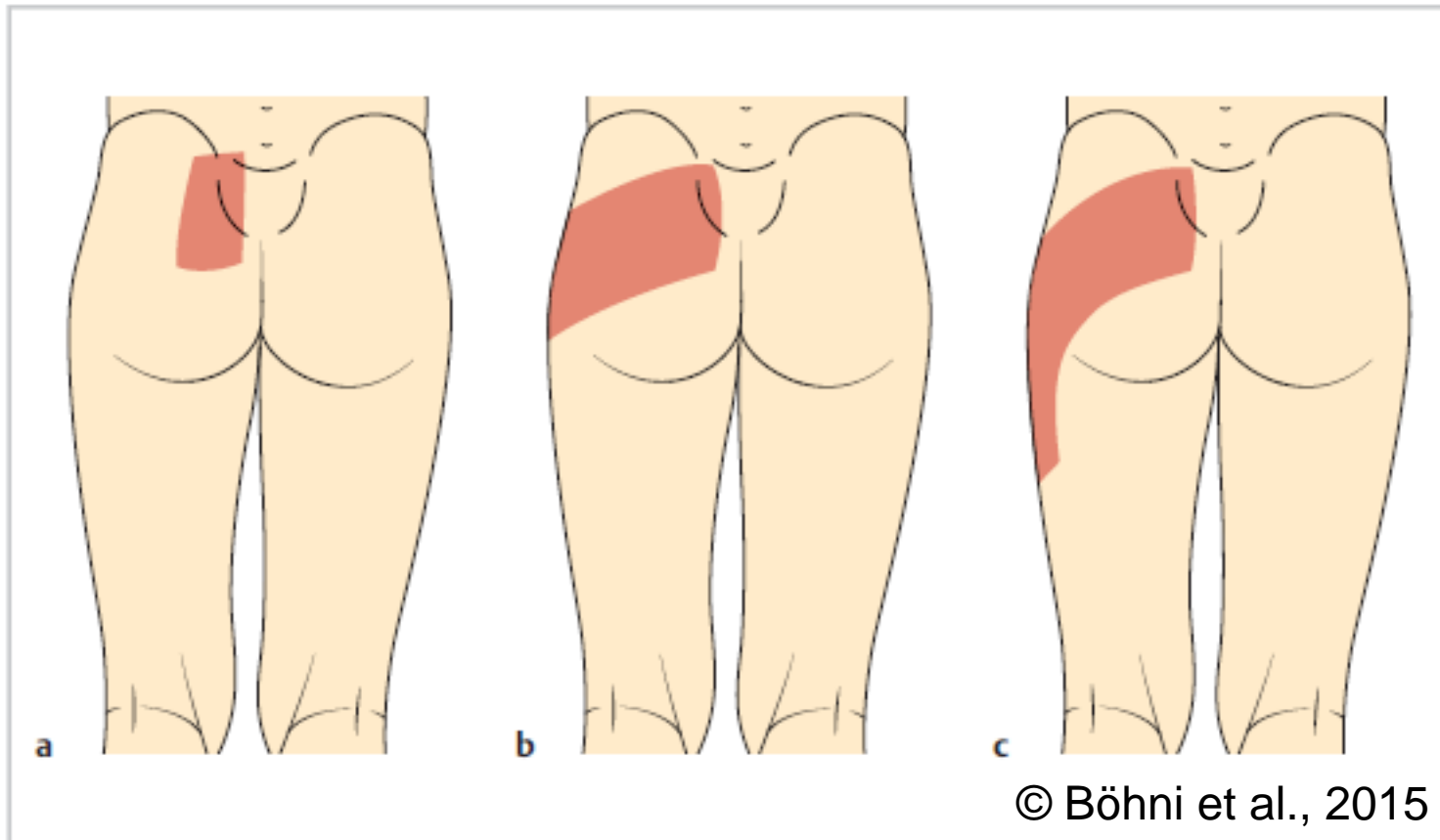
Pain pattern of the SIJ



18 different pain pattern

- Most often in gluteal region until the gluteal fold (94 %), and in the lower extremity (50 %) – on both sides
- But also pain higher than L5 and in the inguinal region
- Differentiation to pathologies of the lumbar spine and the hip joint is not sharp and clear, in the actual case often impossible

What about a „gold-standard“ using fluoroscopically guided injections?



Those injections are unreliable because of variation in innervation!

Fortin et al., 1994

Injection as „gold-standard“?

- Intraarticular needle without fluoroscopy: 12 – 22%
- Intraarticular pain extinction with fluoroscopy: 10 – 62%
- Reasons for false-negative reaction:
 - Free nerve endings with SP & CGRP often not in the synovia but more in the capsule and periarticular
- Reasons for false-positive reaction:
 - Many leakages in the anterior part



Why is SIJ diagnostic so difficult?



Clinical examinations are not always reliable and valid!

How valuable is the clinic?

- Maigne JY, et al. Spine 1996; 21: 1889-1892
- Dreyfuss PH, et al. Spine 1996; 15: 2594-2602
- Laslett M, et al. Austr. J. Of Physiotherapy 2003; 49: 89-97
- Van der Wurff P, et al. Arch Phys med Reh.2006; 87:10-14
- Szadek KM, et al. J Pain 2008
- Hancock MJ, et al. Eur Spin J. 2007; 16:1539-50
- Berthelot JM et al. Joint Bone Spine 2006; 73:17-23



How valuable is the clinic ?

Not reliable:

- **Single test**
- **Unexperienced examiner**
- **Combined with Low Back Pain**

Reliable:

- **At least 3 tests**
 - Sensitivity: 91%
 - Specificity: 78%
- **Experienced examiner**
- **Gluteal pain**
- **Pain provocation instead of palpation of mobility**

Diagnostic: „3 out of 5“

Prospective, randomized, single-blinded study with in this manner „positive“ tested SIJ-patients:

- Manual Therapy: 72% painfree
- Medication: 50% painfree
- Physiotherapy: 20% painfree

Visser LH, Woudenberg NP et al. (2013) Treatment of the sacroiliac joint in patients with leg pain: a randomized-controlled trial. Eur Spine J. 22:2310-7.



Relative mobility of the sacrum towards the ilium, 2-4 °

Orange:

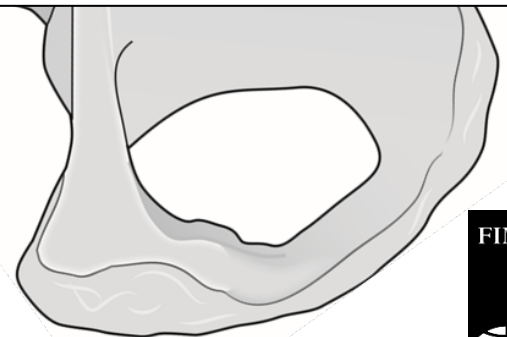
Nutation-movement
of the sacrum (nu)



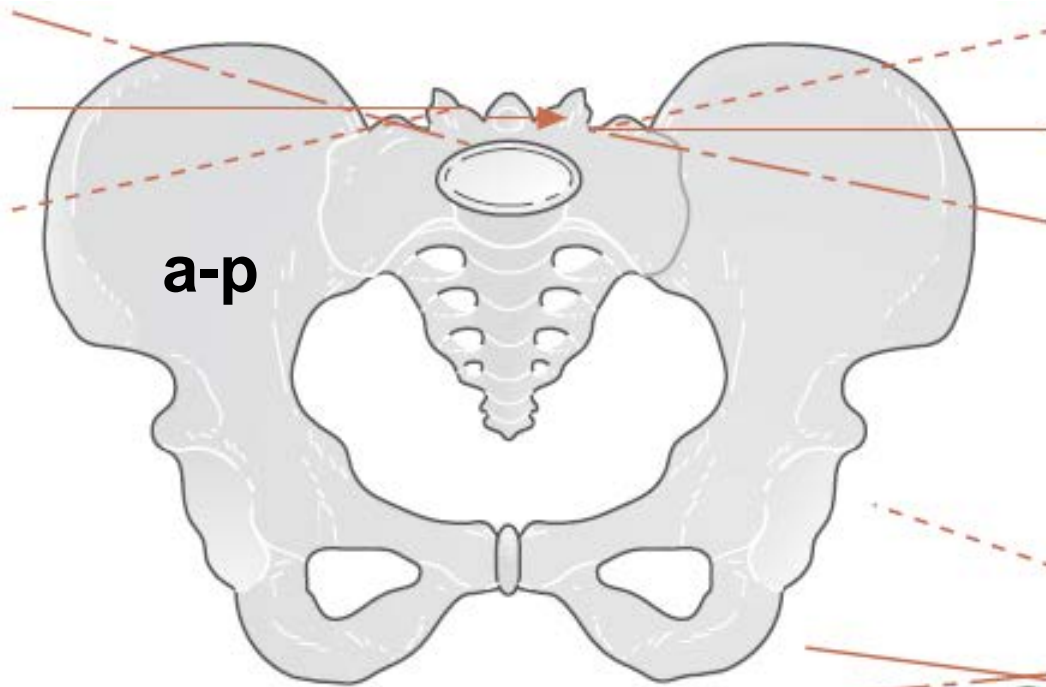
**But only in horizontal position!
Upright: ZERO mobility!**

Green:

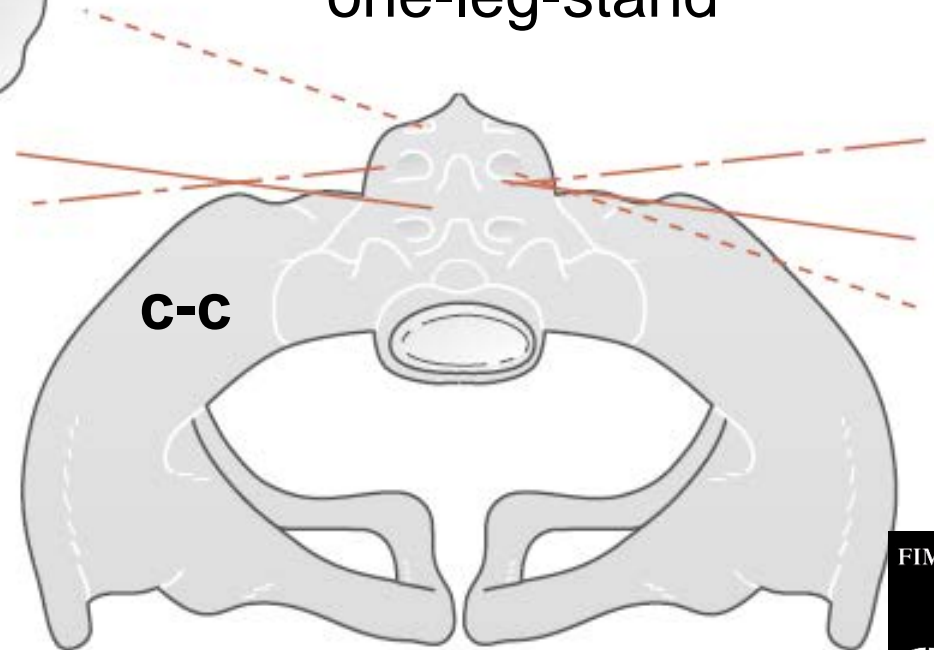
Counter-nutation movement
Of the sacrum (kn)



There is no reliable uniform axis!



Side-different 3-d-axes
of both SIJ of one pelvis
lying, standing and
one-leg-stand



© Paul Klein, 2004

© Böhni et al.,
MM-1, 2014

Purpose of our study

- DGMM-MWE is using and teaching since 65 years a set of diagnostic procedures
- This set was composed by empiric observations and good practical results
- It has never been evaluated
- On the way to a European curriculum according to the UEMS training requirements, it became necessary to evaluate these tests in comparison to others



3 – Steps – Diagnostics: “MIP”

1. Check for segmental/articular **mobility (M)**
2. Check for segmental/articular painful **irritation** points (**I**)
3. Functional **pain provocation** of irritation points (**P**)



Kappa-studies (κ)

- $\kappa = 0.00 - 0.20$: not reliable at all
- $\kappa = 0.21 - 0.40$: sufficient reliability
- $\kappa = 0.41 - 0.60$: good accordance
- $\kappa > 0.61$ „almost perfect reliability“

(© Landis and Koch, 1977)



SIJ extension test

$$\kappa = 0.58$$

(Visser et al., 2013)



Sacrum ventralisation thrust

$\kappa = 0.63$
(Laslett, 2005)



Distraction test

$$\kappa = 0.60$$

(Laslett, 2005)



Compression test

$$\kappa = 0.67$$

(Laslett, 2005)



© JM Werner

Own study 2016/17: (Heymann & Moll, MM, 2018)

- N = 161
- 81 „pain patients“, 80 „healthy controls“
- Testing blinded, in < 5 minutes range
- No therapy/ no follow up
- 3 functional tests
- 3 pain provocation tests
- gluteal irritation point (2 variants) with
 - pain provocation cranial-ventral
 - pain provocation caudal-ventral

Manuelle Medizin 2018 · 56:239–248

<https://doi.org/10.1007/s00337-018-0405-6>

Published online: 29 May 2018

© The Author(s) 2018



CrossMark

Wolfgang von Heymann¹ · Horst Moll² · Geraldine Rauch³

¹ Orthopädische Praxis, Bremen, Germany

² Orthopädische Praxis, Leutkirch, Germany

³ Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Berlin Institute of Health, Institute of Biometry and Clinical Epidemiology, Humboldt-Universität zu Berlin, Berlin, Germany

Study on sacroiliac joint diagnostics

Reliability of functional and pain provocation tests



Design of the study

Formation phase:

- Experienced MM-physicians (>5years)
- Overall agreement was established in a teacher's course with 46 participants; it ranged from 0.83 – 0.96 for the 10 tests
- Prevalence is calculated for the different tests 0.50 – 0.95

Cohens' Kappa-coefficients of tested SIJ-diagnostics



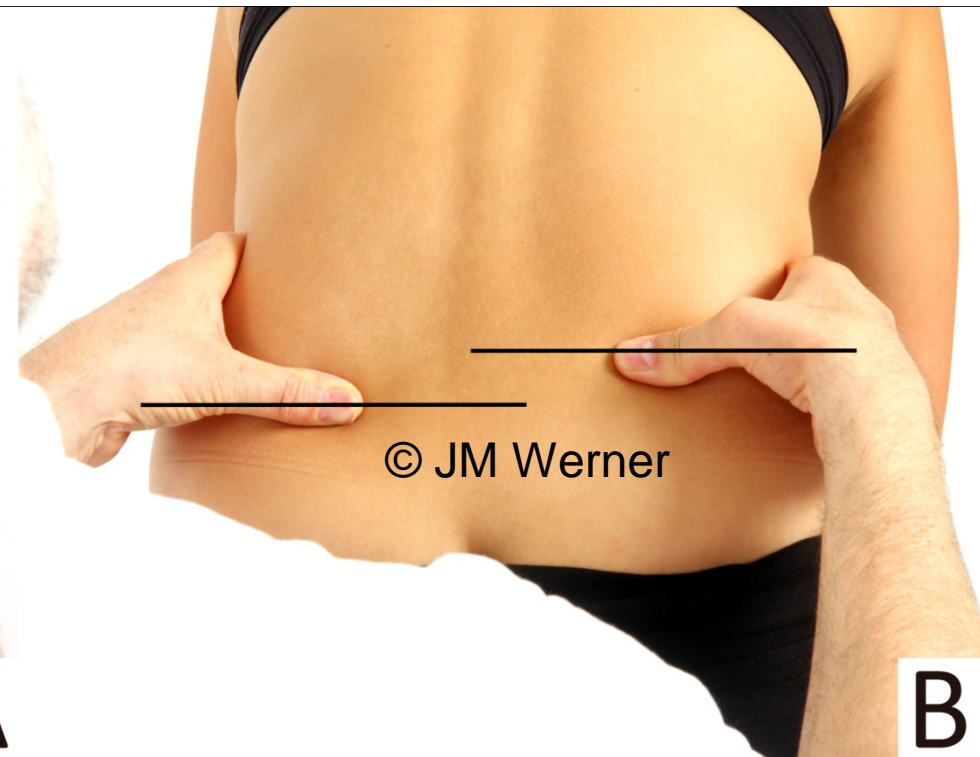
	Right SIJ	Right SIJ	Left SIJ	Left SIJ
	Cohen's κ	95%-CI	Cohen's κ	95%-CI
Bending forward (Piedallu)	0.68 ± 0,089	0.51; 0.85	0.41 ± 0.13	0.16; 0.66
Spine-Test (Gillet-/storck Test)	0.53 ± 0.090	0.35; 0.71	0.59 ± 0.12	0.35; 0.83
Variable leg length (sit-up test)	0.64 ± 0.08	0.48; 0.80	0.71 ± 0.07	0.57; 0.85
Irritation-Point (A)	0.96 ± 0.02	0.96; 1.00	1.00 ± 0.00	
Irritation-Point (B)	0.86 ± 0.04	0.80; 0.94	0.75 ± 0.08	0.59; 0.91
Pain provocation cranial-caudal	0.76 ± 0.06	0.64; 0.88	0.89 ± 0.06	0.87; 0.99
Pain provocation ventral-dorsal	0.93 ± 0.03	0.87; 0.99	0.86 ± 0.07	0.72; 1.00
FAbER Test (Patrick- test/sign of 4)	0.73 ± 0.11	0.51; 0.95	0.34 ± 0.19	0.00; 0.71
Pelvic torsion test (Gaenslen Test)	0.65 ± 0.16	0.34; 0.96	0.39 ± 0.28	0.00; 0.94
Femur-thrust Test (4P-Test)	0.89 ± 0.04	0.81; 0.97	0.89 ± 0.06	0.77; 1.00

“forward bending” or “flexion” test

$\kappa = 0.56$



normal finding

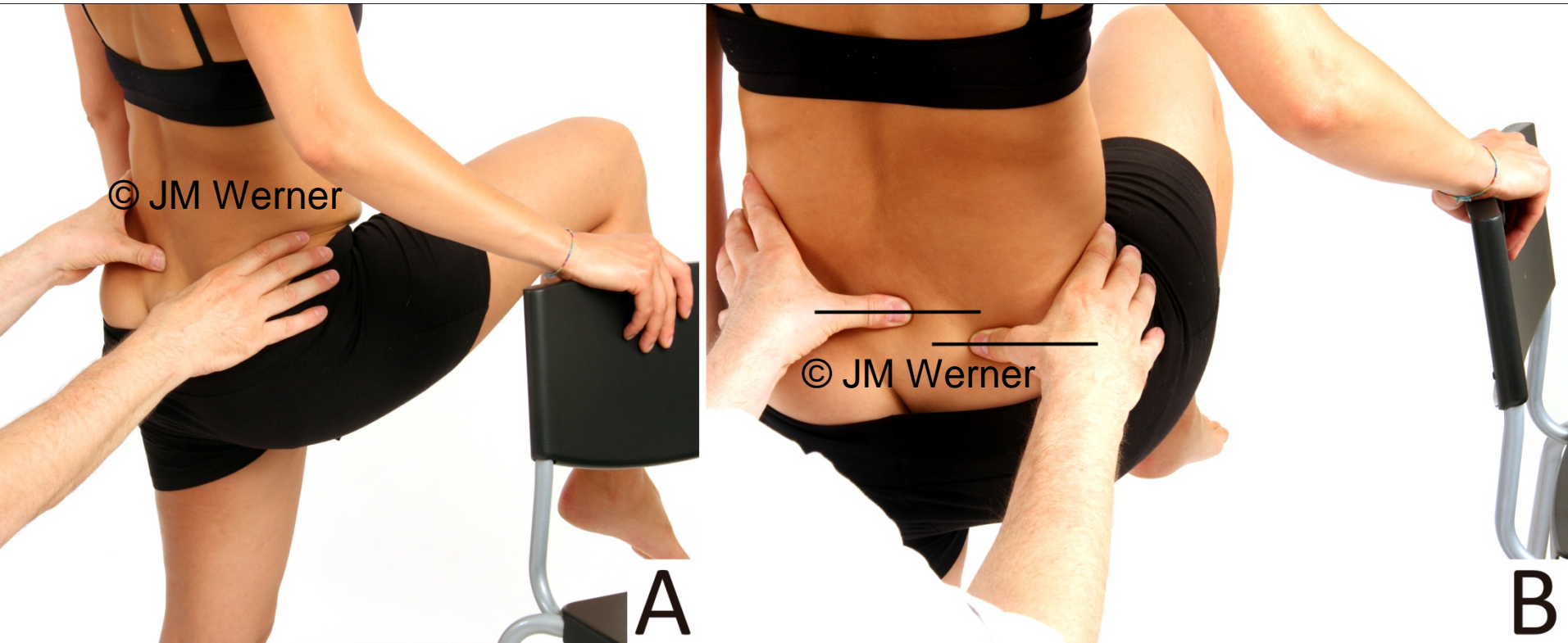


suspicious finding
(> 2 cm)



“Spine-Test”

$\kappa = 0.56$



Normal finding

Variable leg length

$$\kappa = 0.73$$

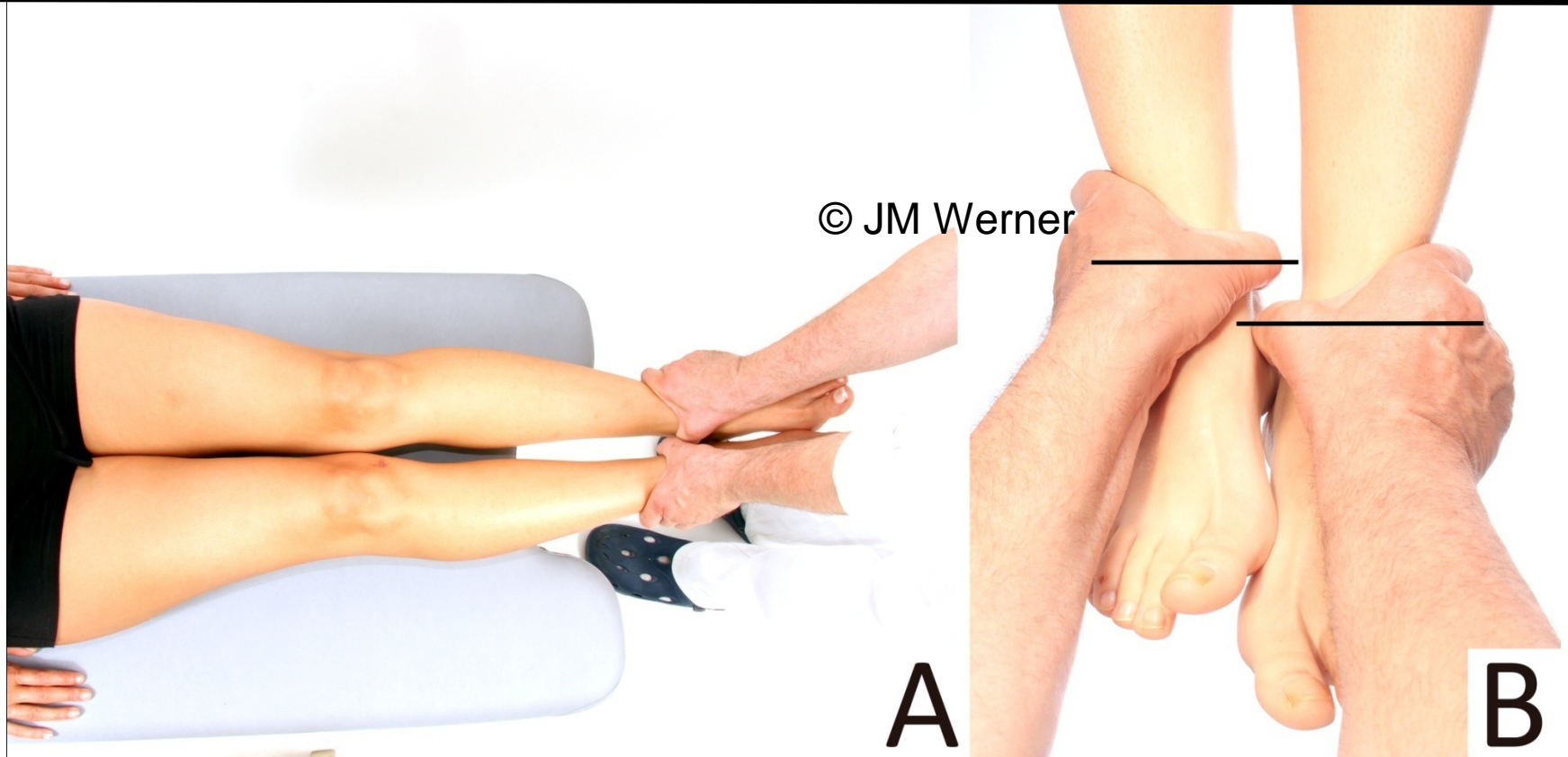
The legs have no contact to the table, examiners arm hanging loose
The person sits up, the thumbs are connected – still at the same length?



Important: to avoid any brainstem convergence,
the eyes must be closed and the teeth must be opened

Variable leg length

$$\kappa = 0.73$$



Sitting up from supine position, in case of a SIJ dysfunction or any asymmetry of neurological control of the dorsal muscles, one leg seems to become longer in relation to the other

Functional testing of the presumed SIJ-mobility seems to be quite sensible, but it is completely unspecific.

It can be used just for orientating screening.



“4P-Test”: posterior pelvic pain provocation test: $\kappa = 0.91$ (Laslett, 2008: $\kappa = 0.88$)



Also: “femur-thrust-test”
or “Ostgaard-Test”

Gaenslen-Test: $\kappa = 0.72$

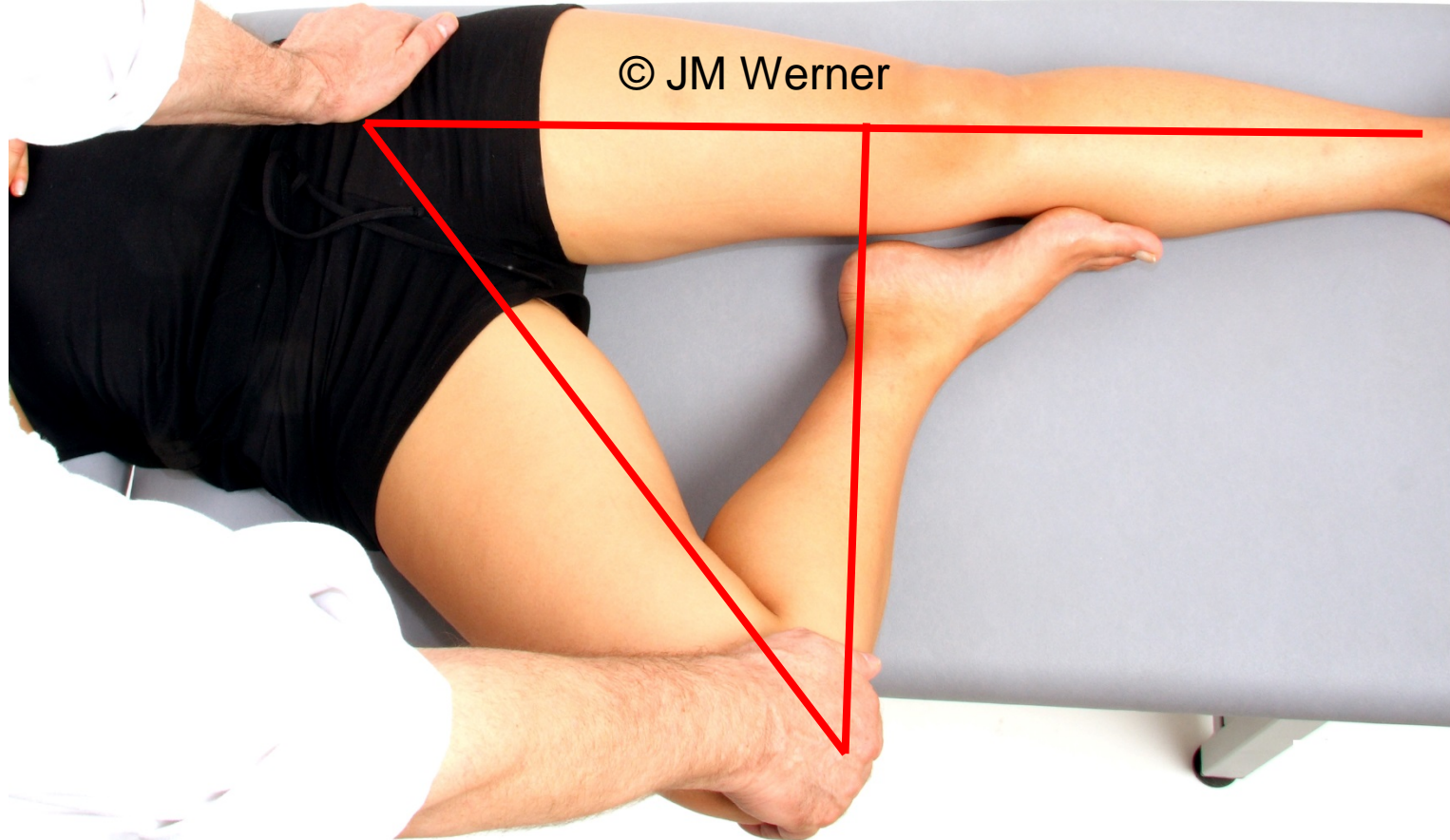
(Laslett, 2008: $\kappa = 0.75$)



FAbER-/Patrick-/sign of 4-Test

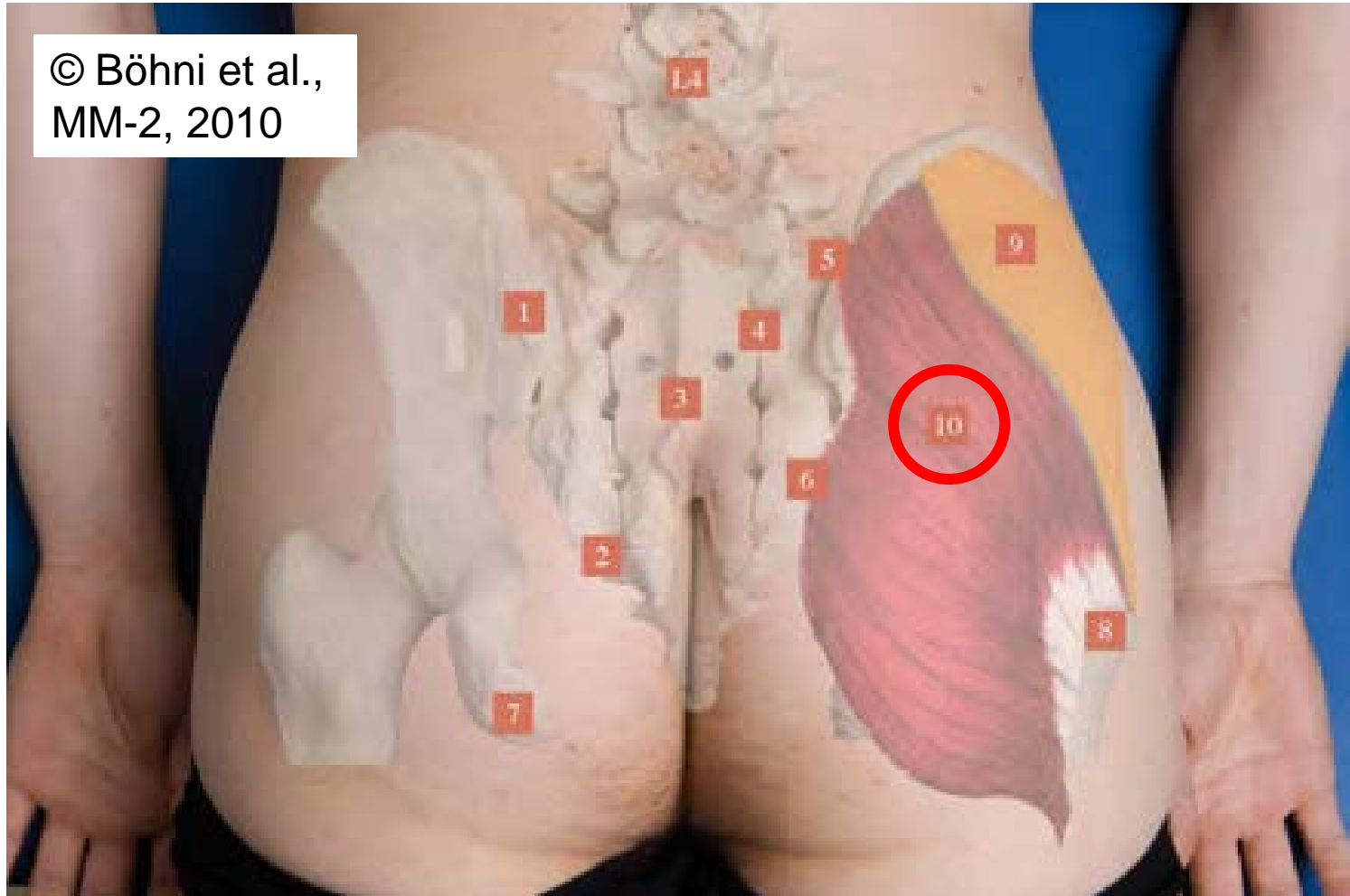
$$\kappa = 0.57$$

(Dreyfuss & Bogduk, 1996: $\kappa = 0.6$)



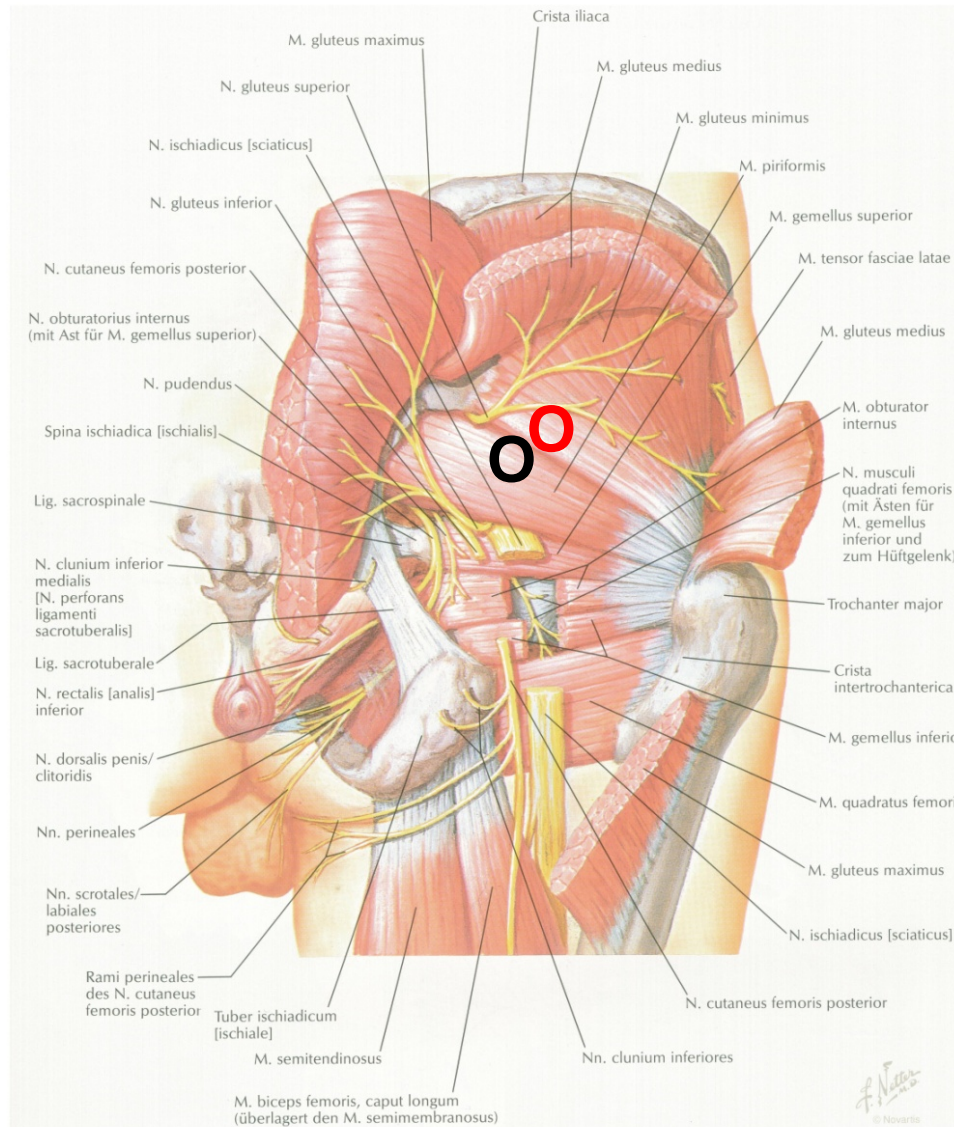
Gluteal irritation

© Böhni et al.,
MM-2, 2010



Many irritation-zones/points

Substratum of the SIJ irritation



SIJ Point 1
SIJ Point 2

SIJ-Irritation point (1) (palpation of medial gluteus tension) (κ: 0.97)



3 fingerbreadths laterally of the SIJ joint gap,
the medial finger under the lower end of SIPS



SIJ-Irritation point (2) (palpation of piriformis tension)

$$\kappa = 0.88$$



- A: take the iliac crest bilaterally with middle finger
- B: thumbs level to sacrococcygeal joint (rima ani)
- C: half distance: deep palpation of irritation

Pain provocation cranial-ventral

Orange: nutation-movement of the sacrum (nu)

Provocation in nutation-direction (orange):

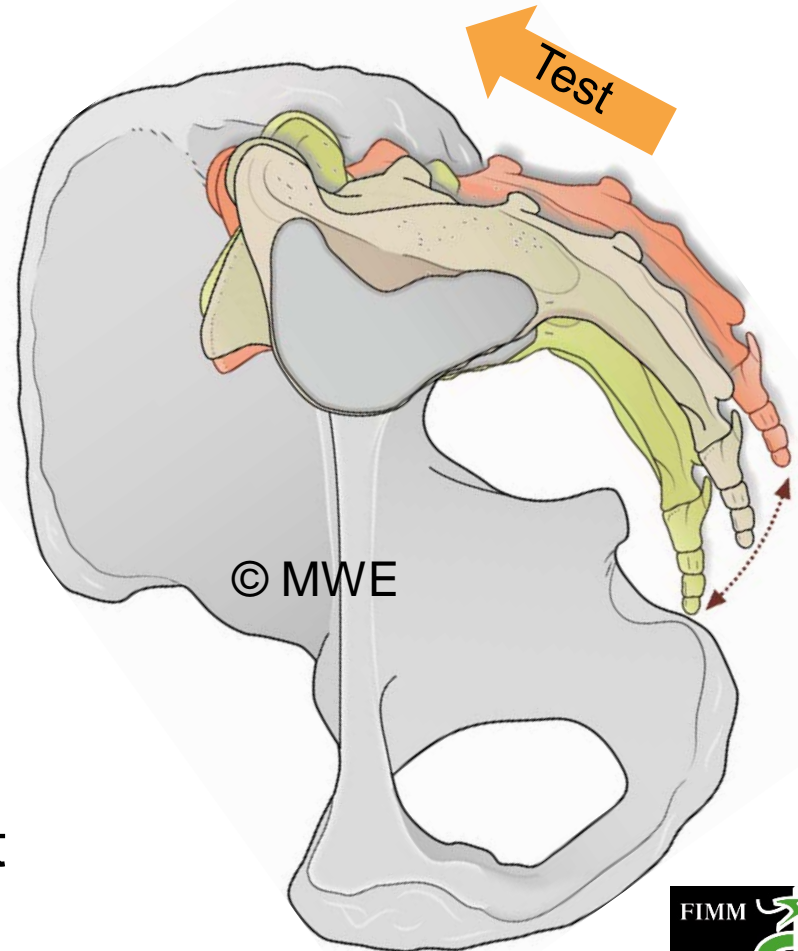
Sacrum (cranial base) to cranial/ventral =
Sacrum at caudal tip dorsal

Any increase of nociception and
nocireaction:

“sensible to nutation”

Free direction: **Counter-nutation**
Therapy: **counter-nutating**

Green: Counter-nutation movement
of the sacrum (cn)



Pain provocation caudal-ventral

Orange: nutation-movement of the sacrum (nu)

Provocation in counternutation-direction
(orange):

Sacrum (caudal tip) to caudal/ventral =
Sacrum at cranial base to dorsal

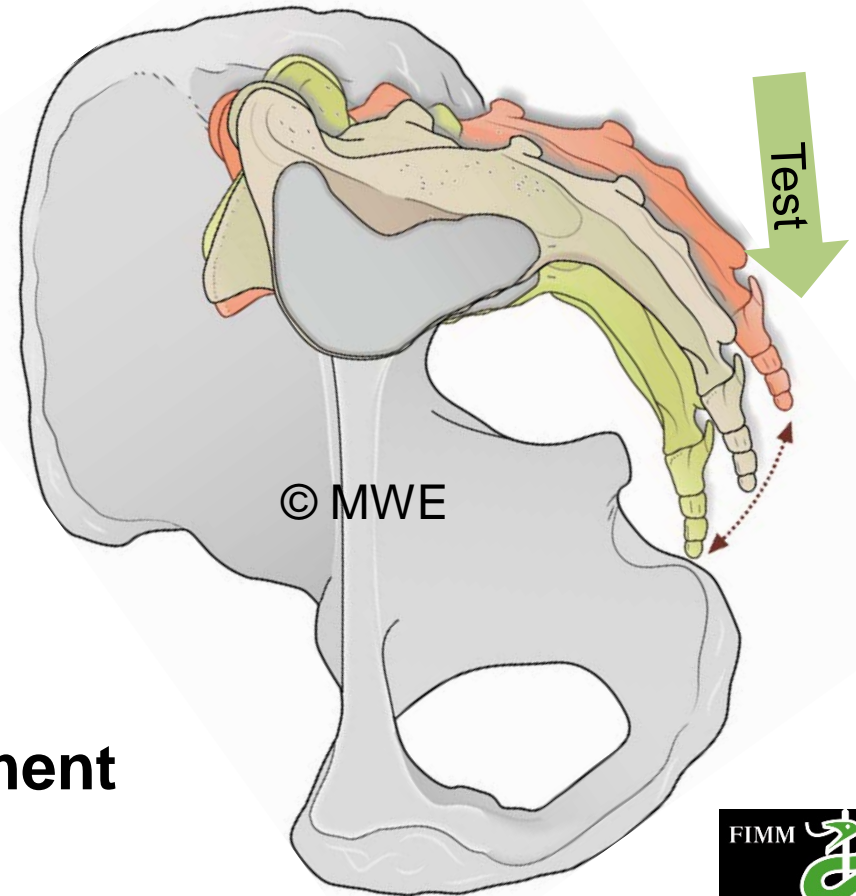
Any increase of nociception and
nocireaction:

“sensible to counter-nutation”

Free direction: **nutation**

Therapy: **nutating**

Green: Counter-nutation movement
of the sacrum (cn)

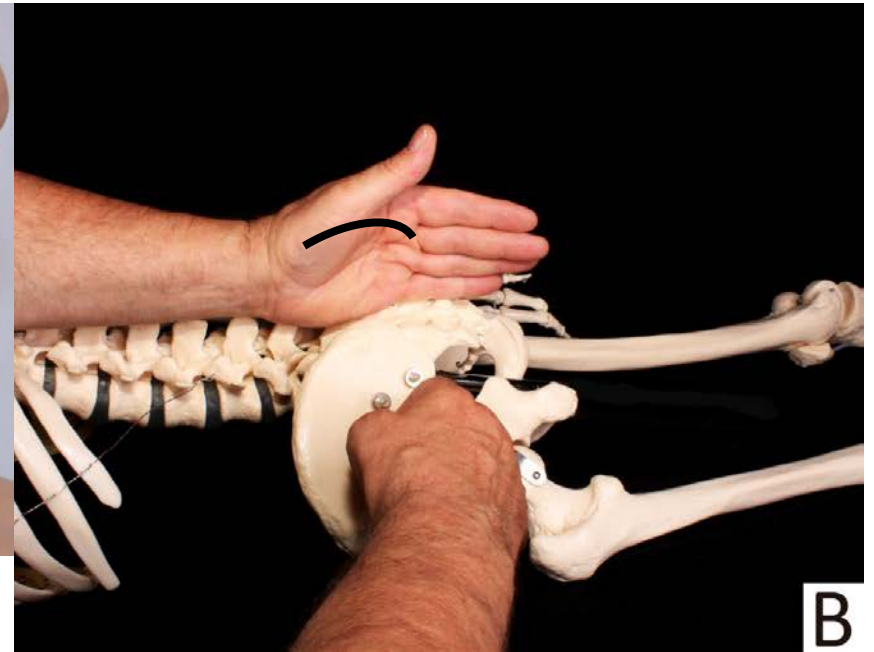


Pain provocation: nutation caudal-ventral at cranial base



$\kappa = 0.88$

Pain provocation: counter-nutation caudal-ventral at caudal tip



$\kappa = 0.85$

Interrater-reliability: (minimum 3 pain-tests “positive”)

- No signs for any SIJ dysfunction
 - N = 80 $\kappa = 0.93$
- Dysfunction symptoms right SIJ
 - N = 61 $\kappa = 0.95$
- Dysfunction symptoms left SIJ
 - N = 20 $\kappa = 0.94$

Summary

- Still, there is no gold standard for the diagnostic of a SIJ dysfunction
- Sufficient proof for reliability, sensitivity and specificity is a combination of a minimum of three positive pain-provocation tests
- To our conviction, these include the
 - the 4-P-Test
 - the gluteal irritation point
 - provocation-direction: cranial-ventral
 - provocation-direction: caudal-ventral

Thank you for your attention!

