Impact of Pelvic Incidence on the Sagittal Lumbo-pelvic Alignment in Standing from a Sitting Position

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Introduction

- Low back pain during sit-to-stand (STS) is a very common symptom.
- Most people in modern societies spend the majority of their time indoors, sitting on a chair.
- Sagittal spinal alignment is usually analyzed in standing position. For understanding of symptoms associated with postural changes, however, it must be analyzed in various positions.
Purpose

The purpose of this study was to investigate the relationship between lumbar and pelvic segment in STS movement.

Study Participants

- 50 healthy adult volunteers without any spinal symptoms
- 22-48 y/o (mean 29 y/o)
- 28 men and 22 women
Parameters

- lumbar lordotic angle (L1-L5)
- sacral slope (SS)
- pelvic tilt (PT)
- pelvic incidence (PI)

- range of intervertebral motion (IV ROM)
  L1-2, L2-3, L3-4, L4-5, L5-S
Postures

Sitting
- upright
- anteflexed

Standing
- upright
- anteflexed
Changes of Sagittal Parameters during STS

degree

-10 0 10 20 30 40

L1 L5
SS
PT
seat off
IV ROM during STS

Before seat off  After seat off

degree

L1-2  L2-3  L3-4  L4-5  L5-S
Correlation between Changes of L1L5 and PI in STS

$r=0.42, p=0.028$
Sagittal Alignment in STS

- Pelvis was retroverted in sitting position and gradually anteverted in STS.

- Lumbar lordosis was decreased in sitting then temporarily more decreased, and increased after thighs off.

- L4-5 and L5-S segment have wide range in STS.
Pelvic Incidence

- PI determines a pelvic capacity to compensate the sagittal imbalance.  
  (Lu Huec et al, Eur Spine J, 2011)  
  (Roussouly et al, Eur Spine J, 2011)

- LL is proportional to PI.

- An Individual with a high PI has large compensative capacity of the pelvis and needs a large lumbar lordosis to maintain an upright standing posture economically.
In Patients with Postoperative Flat Back

Limited pelvic anteversion due to postoperative flat back could cause overload on hip extensors, resulting in lumbo-gluteal pain STS.

In High PI Patients with Multiple Lumbosacral Fusion

Hip ROM exercise is very important for high PI patients with multiple lumbosacral fusion because of less lumbo-pelvic compensative ability in STS.
Conclusions

- Pelvis was retroverted in sitting position and gradually anteverted in STS.

- Lumbar lordosis was decreased in sitting then temporarily more decreased, and increased after thighs off.

- High PI patients with multiple lumbosacral fusion or flat back could be subject to lumbo-gluteal pain because of limited lumbo-pelvic compensation during STS.

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