Role of pelvic asymmetry in skeletal posture

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Abstract
Objectives
To investigate the signs of pelvic asymmetry in skeletal posture and to describe three novel maneuvers directed at iliac asymmetry, sacral torsion, and iliosacral inflare/outflare.

Methods
Retrospective study of consecutive patients with musculoskeletal complaints. A palpation Meter® tool was used to examine the position of iliac crests and inferior scapular angles. The patients performed three self-correcting muscle-energy maneuvers.

Results
There were 103 patients (37 men, age 12 to 80 years). Reversible pelvic obliquity was found in 100 (97.1%) patients. Iliac asymmetry was associated with anteriorly rotated ilium in 51% with ipsilateral leg lengthening. The 49% had an upslip of the ilium associated with leg shortening. The 53 patients were re-examined and, of them, 84% demonstrated improved pelvic alignment.

Conclusions
Reversible pelvic obliquity in patients with musculoskeletal pain might be more common than commonly assumed. This study proposes three novel maneuvers as an alternative to conventional manual treatment of pelvic obliquity.

Keywords:
sacroiliac joint, scoliosis, pelvis, pelvic tilt, malalignment

INTRODUCTION
In 1936, Pitkin and Pheasant have described the malalignment syndrome of pelvis – "sacroarthrogenetic telalgia" (1). It comprises three features: a dysfunctional sacroiliac joint causing referred pain in lower extremities, an oblique sacrum resulting in compensatory spinal scoliosis, and an asymmetrical position of bones appearing as leg length discrepancy. Pitkin and Pheasant have suggested a treatment aiming at restoring pelvic alignment, equalizing leg length, and straightening out scoliosis. In 1980, DonTigny has proposed an anteriorly rotated dysfunction of the sacroiliac joint might cause pelvic obliquity, a high iliac crest, an apparent lengthening of the ipsilateral leg, and a laterally deviated lumbar spine contributing to developing low back pain (2). DonTigny has suggested that sacroiliac joint mobilization might correct the disorder. Schamberger has advised the reversible nature of pelvic obliquity and its relationship with leg length discrepancy and functional scoliosis (3). He has described the relationship between the asymmetrical alignment of pelvis, trunk, and extremities and asymmetrical weight-bearing patterns, diminished ranges of motion, and increased tension in muscles, tendons, and ligaments. In line with earlier literature on manual therapy, he has referred to three possible malalignments of pelvic bones: iliac asymmetry (either rotatory malalignment or upslip); sacral torsion around a diagonal axis; and iliosacral inflare or outflare (medially or laterally rotated ilium). Schamberger has believed that malalignment of pelvis and/or spine is presented in 80% to 90% of total adult population and might be responsible for back pain in 50% to 60% of the cases (4).

Several studies have investigated sacroiliac joint dysfunction, functional scoliosis, and leg length discrepancy as separate entities. However, the possible interdependency of these three conditions has received only little attention. Our previous study demonstrated that even 80% of patients visiting a specialist in PRM might have reversible pelvic asymmetry related to back (5). The objective of present study was to describe the signs of pelvic asymmetry and to introduce three novel maneuvers directed at iliac asymmetry, sacral torsion, and iliosacral inflare or outflare using patients’ own muscular effort without mobilization performed by a physician.

METHODS
This was a retrospective study of patients visiting a private doctor’s office (a specialist in PRM) in 2017 due to back pain. The consecutive medical records were retrieved for the analysis. No additional examination or intervention related explicitly to the study have been performed. Thus, no approval from an ethical board was needed. The assessment of three possible pelvic malalignments were added to a usual PRM examination: 1) a sagittal iliac...
asymmetry, 2) a sacral torsion around a diagonal axis, and
3) transverse iliolumbar inflare or outflare. The patients
were instructed to perform three muscle-energy aligning
maneuvers. The assessment was performed before and
after maneuvers.

To measure the level of iliac crests and inferior scapular
angles, Palpation Meter (PALM®, Performance
Attainment Associates, Roseville, MN, USA) was used.
This instrument has been found to be valid, reliable, and
precise tool to measuring scapular position (6,7) and pelvic
crest height difference (8-10). It combines a caliper and an
inclinometer that produce an estimate using a sine function
slide ruler. A 12-mm thick wooden plate was used to
compare a leg length in up-right position.

**Examination steps**

**Step 1. Iliac asymmetry**

A physician sought after three possible findings: a
height of iliac crests, a height of scapulae, and an
anteroposterior position of shoulders. Leg length
discrepancy was estimated in supine position placing
assessor’s thumbs caudal to the medial malleoli and
comparing the thumbs’ position. If discrepancy was
identified, then a 12-mm elevating block under a patient
foot was placed when standing and the iliac crest height
was compared. Figure 1 shows the procedure applied in
iliac alignment.

**Step 2. Sacral torsion**

Iliac crest level was re-assessed using a PALM® tool. If
ilia had become even, then the observed symmetry was
confirmed by placing 12-mm blocks under each foot in
order to achieve equal elevation in both iliac crests. After
that, the level of the inferior scapular angles was measured,
and the anteroposterior relationship of inferior sacral
lateral angles and shoulders was compared. Asymmetry
observed in all three points was considered to indicate
sacral torsion and a patient was instructed to perform a
sacrum aligning maneuver (Figure 2). Subsequently, the
height of the scapular angles was measured in up-right
position and the anteroposterior relationship of the lateral
and inferior sacral angles and shoulders was reassessed. If
all of these three factors showed symmetry while a spine
was still asymmetric, an Adam’s forward flexion test was
performed to detect possible idiopathic scoliosis.

**Step 3. Inflare and outflare**

After iliac crests and sacrum were aligned, the “standing
forward flexion test” was performed. An assessor placed
his thumbs on a patient’s posterior superior iliac spine with
a patient bending forward. The cephalad asymmetrical
movement of one of the posterior superior iliac spines
indicated sacroiliac joint dysfunction on that side. Later, a
patient’s feet position was assessed in supine position.
More outward rotated foot on the side of positive flexion
test was considered to indicate iliolumbar outflare and more
inward rotated foot was considered to indicate inflare.

**RESULTS**

The age of the 103 patients ranged from 12 to 80 years,
37 were men. Reversible iliac asymmetry was found in 100
out of 103 patients (97%). Fifty-one patients had an
anteriorly rotated ilium; 45 on the left side and six on the
right side. Forty-nine patients had an upslip; 35 on the left
side and 14 on the right side. Both asymmetries were
associated with a higher ilium on the affected side. The
measured height difference between the iliac crests using a
PALM® tool was 20 (10 to 28) mm. The average
A difference in height of scapular angles was 12 (0 to 20) mm. Table 1 presents positional differences between iliac anterior rotation and upslip. When rotated anteriorly, the 12-mm lift under the ipsilateral leg was associated with the iliac crest to be further elevated, while in upslip, the placement of the lift under the side of the upslip was associated with the iliac crest iliac crest descending to the level of the opposite side. This observation seemed paradoxical. A sacral torsion (noticeable after adjusting the ilia) was observed in 98 patients. The average difference in heights of scapular elevation was 9 (6 to 16) mm. In 29 cases, scapular elevation was on the opposite to sacral torsion side. Otherwise, scapular elevation was on the same side as the elevation associated with a sacral torsion. Fifty-one patients were tested positive for sacroiliac outflare or inflare: 39 patients had right and 11 had left outflare and one patient had left inflare. In all the cases, the proposed maneuvers resulted in corrected sacroiliac malalignment.

Fifty-one patients were re-tested at their second visit to a doctor. Of them, alignment was apparently achieved concerning all three possible malalignments in 43 (84 %) patients. Of eight patients with sacral asymmetry at the second assessment, three had an anterior iliac rotation with sacral torsion, three had a sacral torsion, one had a sacral torsion with outflare, and one patient had inflare.

**DISCUSSION**

The results of this retrospective observational study suggest that a dysfunctional sacroiliac joint may result in pelvic asymmetry associated with sacroiliac malalignment. All three the proposed maneuvers seemed to correct sacral asymmetry. The high prevalence of reversible pelvic obliquity observed in this study was in line with the results of Schamberger, who has reported that the malalignment of the pelvis and spine might exist in up to 90% of adults. Also, as reported by Shaw, even 98% of patients with low back pain might have mechanical dysfunction of sacroiliac joint presented as pelvic malalignment and leg length discrepancy (11).

The physiological movement of the sacroiliac joint comprises the combination of rotation and translation.

**CONCLUSIONS**

Reversible pelvic obliquity in patients with musculoskeletal pain might be more common than commonly assumed. This study proposes three novel maneuvers as an alternative to conventional manual treatment of pelvic obliquity.
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