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Original Research Article

Is there any coexistence of sacroiliac joints dysfunction with dysfunctions of occipito-atlanto-axial complex? Part II: The biomechanical aspect

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ABSTRACT

Introduction: As the sacroiliac joints (SIJ) join two kinematic chains, the pelvis and the vertebral column, their functional disorders cause secondary changes in the musculoskeletal system. Other reasons concerning a connection between its distant parts are tensegrity principles that govern tension distribution in tendons, muscles, fasciae and ligaments. Our hypothesis was that due to a biomechanical connection between SIJ and cervico-cephalic joints (CCJ), dysfunctions in the SIJ can determine dysfunctions in the CCJ.
Aim: The aim of this study was to assess various types of SIJ dysfunctions (ilio-sacral and sacro-iliac) and their possible coexistence with CCJ dysfunctions.
Materials and methods: The study group comprised 80 patients with low back pain, 40 of whom were diagnosed with SIJ dysfunctions. The examination of the suboccipital region by Kaltenborn and Evjenth was conducted by a researcher who was unaware of the results of the pelvis examination. StatGraphics Centurion XV was employed for data analysis.
Results and discussion: CCJ dysfunctions were detected in almost all subjects. There was a statistically significant difference in mobility and in gliding of the C_0–C_1 segment between both groups. The restricted mobility on the left side of the C_0–C_1 segment was statistically significant. The detected abnormal stability on the right side of the C_1 motion segment in the study group did not correlate with the side of the SIJ dysfunction.
Conclusions: There was no dominant dysfunction of the SIJ. The prevalence of dysfunctions of the upper cervical motion segments was high in the study group. There was a tendency towards larger numbers of dysfunctions concerning the right CCJ than the left one observed in patients with SIJ dysfunctions.

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1. Introduction

As the sacroiliac joints (SIJ) join two kinematic chains, the pelvis and the vertebral column, their functional disorders cause secondary changes in the musculoskeletal system. Other reasons for a connection between its distant parts are tensegrity principles that govern tension distribution in tendons, muscles, fasciae and ligaments.[1,4,5,21,22,23,24]

The connection between SIJ and the cervico-cephalic joints (CCJ) of the vertebral column is often discussed because of their function as the opposite last links in the biomechanical chain of the vertebral joints.

Although it is obvious that compensatory mechanisms in the musculoskeletal system exist, in particular in the vertebral column and pelvis, their function and biomechanical basis are still underestimated and provoke more questions than answers. As the main biomechanical function of the vertebral column is to form a vertical axis for the human body and to enable the head and extremities to work properly in space both in dynamic and static vertical positions, knowledge concerning the range of its dysfunction is of vital importance for planning further treatment.

2. Aim

The aim of this study was to assess the prevalence of sacroiliac dysfunctions and iliosacral dysfunctions in patients with SIJ malfunctions. Moreover, it aimed at investigating whether there is any coexistence of SIJ dysfunctions and the dysfunction of upper cervical motion segments. The assumed hypothesis was that due to a biomechanical connection between them, dysfunction in the SIJ can determine dysfunction in the CCJ.

3. Materials and methods

3.1. Patients

This study was carried out with 80 patients admitted to the Department of Medical Rehabilitation at the Medical University of Łódź due to low back pain.

In total, 40 patients met the inclusion criteria for the study group (G1) as they had SIJ dysfunctions diagnosed during the initial examination. The other 40 patients served as the control group (G2) since their SIJ functioned properly. The demographic description of all these patients is shown in Table 1.

Table 1 – Demographic description of the study group (G1) and the control group (G2).

Demographic parameters	G1	G2
Total	40	40
Female	28	23
Male	12	17
Mean age (years)	35.8 ± 9.7	38.7 ± 11.2

3.2. Examination

All patients completed an examination chart comprised of questions concerning personal data, age, job and its characterization, physical activity, medical diagnosis and current complaints (i.a., since when had complaints been present and how they had been hitherto treated).

To be included in this study group, patients had to meet the criteria for the SIJ dysfunction by Greenman.[7,8,13] These are a positive Piedellu test in a sitting and/or standing position, asymmetry in the topographical anatomy of the pelvis (sacrum, ilia), irritation of the sacrotuberous ligament and/or iliolumbar ligament, and posterior sacroiliac ligament.

An examination of the occipito-atlanto-axial region was carried out for each patient by a researcher who was not aware of the results of the lumbar-pelvic-iliac region examination. It consisted of testing of global mobility in the C_0–C_1 and C_1–C_2 segments with a goniometer, palpation of gliding in the C_0–C_1 and C_1–C_2 segments by Kaltenborn,[10] testing of indicatory muscles for the C_1 and C_2 segments, and testing the ligaments of CCJ by Kaltenborn.[10]

A lack of motion meant jamming in a joint; a very restricted motion meant the range of motion reduced by 5–10°; a lightly restricted motion meant the range of motion reduced by 0–5°; and hypermobility meant the range of motion more than the normal one by 5° or more.

In the sagittal plane, patients flexed and extended their heads to test the rectus capitis posterior major and the rectus capitis posterior minor as indicatory muscles for the C_1 segment. Muscle strength was estimated by the researcher in a subjective manner. In the horizontal plane, patients rotated their heads to the right and to the left to test the obliquus capitis superior and the obliquus capitis inferior as indicatory muscles for the C_2 segment. Muscle strength was assessed by a comparison between left and right head rotations.

3.3. Statistical analysis

StatGraphics Centurion XV was used for data analysis. Statistical significance was accepted at an $\alpha \leq 0.05$.

Parametric and nonparametric statistical tests were employed depending on the distribution of the data.

The fraction test was employed to determine the distribution of SIJ dysfunctions. The tests of proportions were used to compare the levels of the CCJ dysfunction in correlation with the SIJ function. The correlations between the SIJ dysfunction and the upper cervical motion segments, as well as between the sides of dysfunction, were estimated employing the arccosine test. The χ^2 test was used to analyze gliding motions in the CCJ and muscles strength. Fisher's exact test was used to correlate the parameters of cervical segments stability and Yule's coefficient to correlate the side of the SIJ dysfunction with the side of dysfunction in the upper cervical motion segments.

4. Results

4.1. The distribution of SIJ dysfunctions

There was no difference in the presence of sacroiliac (21 patients) and iliosacral (19 patients) dysfunctions in the