The influence of pelvic morphology to sacroiliac joint pain between young and elderly patient: A cross-sectional study.

Author ○Masuda Kazuto[1-3] Kasano Yuko[4] Nishino Yudai[5] Kawada Tatsuhito[5] Kawamura Kazuyuki[1] Kida Noriyuki[6]

1) Department of Physical Therapy, International institute of Medical Therapy
2) Ritsumeikan University Research Organization of Ritsumeikan Global Innovation
3) Graduate School of Science and Technology, Kyoto Institute of Technology
4) Department of Physical Therapy, Chubu Gakuin University
5) Department of rehabilitation, Ieda Orthopedic Rehabilitation Clinic
6) Faculty of Arts and Sciences, Kyoto Institute of Technology University

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【Abstract】

Background:

In Japan, the age-specific incidence of sacroiliac joint pain (SIJP) shows a bimodal distribution, with peaks observed in the 30-39 and 70-79 age groups. Abnormal pelvic positioning has been implicated as a cause, but no studies have examined the causes of SIJP in these two age groups.

Purpose:

To compare the pelvic morphology of young and elderly patients with SIJP.

Methods:

The study included patients with SIJP in the two age groups of 30-39 years (Group Y) and 70-79 years (Group E). The mean ages of patients in Group Y and E were 35.1 ± 5.0 and 73.6 ± 3.1 years with 18 and 19 patients in each group, respectively.

Physical measurements and pelvic morphology measurements were determined. Pelvic morphology was measured using a Martin pelvimeter. The following measurements were obtained: interspinous diameter (ID), posterior superior iliac spinous diameter (PD), first/second oblique diameters (FOD/SOD), and lateral distance. The degree of pelvic opening (PO) was calculated by dividing PD by ID, and pelvic torsion (PT) was calculated by dividing FOD by SOD and further dividing the absolute value of SOD/FOD by the height measured in meters. These measurements and physical measurements were analyzed using an unpaired t-test, and $p<0.05$ was considered significant. This study was conducted in accordance with the DECLARATION OF HELSINKI.

Results:

ID was significantly higher in group E than in group Y (Group Y; 24.0 ± 1.3 cm, Group E; 25.8 ± 1.5 cm) ($t = -2.39$, $p = 0.02$). PT was significantly higher in group E than in group Y (Group Y; 0.54 ± 0.41, Group E; 0.89 ± 0.38) ($t = -4.33$, $p<0.01$). There were no significant differences in the other measurement values. There was a significant gender difference bias in the two groups (Group Y: $\chi 2 = 5.56$, $df = 1$, $p = 0.02$; Group E: $\chi 2 = 6.37$, $df = 1$, $p = 0.01$).

Conclusion:

Pelvic morphology was not associated with SIJP, as there was no significant difference in PO. However, pelvic asymmetry was involved in SIJP in the elderly. As SIJP is significantly more frequent in females, there may be a female-specific effect on the sacroiliac joint.

【Introduction】

Sacroiliac joint pain (SIJP) accounts for 30% of all lower back pain in patients[1]. The causes of SIJP have been suggested to be the morphological changes in the sacroiliac joint surface and its sequelae of sacroiliac joint surface degeneration[2]. The sacroiliac joint shows superficial cartilage degeneration in the 20s, deep cartilage degeneration and osteophyte formation in the 30s, and degeneration of the subchondral bone in the 40s, followed by further degeneration over time and cartilaginous fusion[3-5]. Thus, the sacroiliac joint, like other joints, undergoes degenerative changes, and the risk of pain increases with age. Therefore, it has been reported that there is no gender difference in the occurrence of sacroiliac joint disorders[6]. In contrast, joint laxity in the sacroiliac joint after delivery[7] and preauricular grooves[8] based on the delivery experience occur as causes specific to women. Therefore, women are more likely to experience higher stresses and loads on the sacroiliac joint along with associated stresses on the ligament and distortion of the joint[9]. Asymmetry in pelvic alignment caused by sacroiliac joint distortion has been indicated as a risk factor in the development of sacroiliac joint disorders[10]. Thus, pelvic alignment changes transform the kinematic environment of the pelvic girdle and are strongly implicated in the development of sacroiliac joint disorders[11]. However, the alignment of the pelvis is different according to the sex and age, and so, the cause of sacroiliac joint disorders may differ among individuals. In general, the age of onset for

	Young group	Elderly group
Nuber	18	19
Age (y.o.)	35.1±5.0	73.6±3.1
Height (cm)	160.6±5.5	153.3±8.4
Weight (kg)	57.6±10.1	54.4±7.4
BMI (kg/m2)	22.4±4.0	23.2±3.1
Delivery experience	92.9%	93.3%

Table 1. Group characteristics

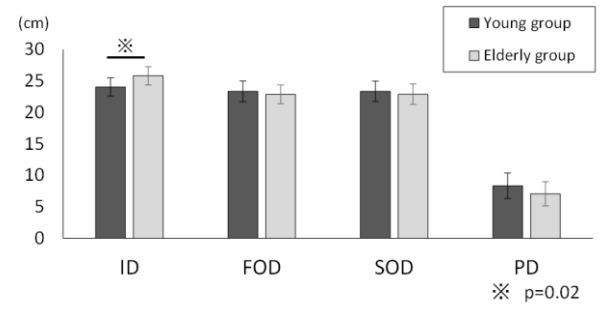

Fig 1. External pelvimetry measurement value

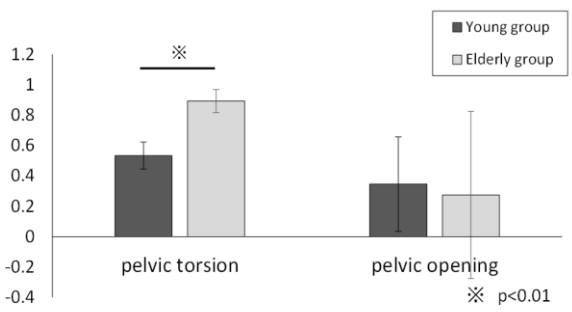

Fig 2. Pelvic torsion value and opening value

	Male	Female	
Group Y	4	14	χ^2=5.56, df=1, p=0.02
Group E	4	15	χ^2=6.37, df=1, p=0.01

Table 2. Results of Chi-square test for Group Y and E

sacroiliac joint disorders in the Japanese population is bimodal with peaks in the 30s and in the 70s. However, no previous studies have investigated the characteristics of different age groups in patients with SIJP. The purpose of this study was to compare the differences in pelvic morphology and gender between the peak ages of sacroiliac joint disorders in Japan (30s and 70s) and to investigate the relationship of these groups with SIJP.

【Method】

The subjects were 18 patients in the young group (Group Y) aged 30 to 40 years (4 males and 14 females; height: 160.6 ± 5.5 cm; weight: 57.6 ± 10.1 kg; age: 35.1 ± 5.0 years) and 19 patients in the elderly group (Group E) aged between 70 to 80 years (4 males and 15 females; height: 153.3 ± 8.4 cm; weight: 54.4 ± 7.4 kg; age: 73.6 ± 3.1 years) with a diagnosis of sacroiliac joint disorder. The delivery experience rates in the young and elderly groups were 92.9% and 93.3%, respectively. The details of each group are shown in Table 1.

Measurement of the pelvic morphology was performed by external pelvimetry using the Martin pelvimeter. The interspinous diameter (ID), distance between the posterior superior iliac spines (PD), first/second oblique diameters (FOD/SOD), and lateral conjugates were measured. The degree of pelvic opening (PO) was calculated by dividing PD by ID, and pelvic torsion (PT) was calculated by dividing the absolute value, which was calculated by dividing FOD by SOD, by the height. The exclusion criteria were an experience of abnormal delivery, and a difference of ≥0.5 cm between the bilateral lateral conjugates.

The external pelvimetry and physical measurements were compared using an unpaired t-test. In addition, a χ-square test was performed for the gender difference bias in each group. SPSS software (IBM, SPSS Statistics Version 23) was used for statistical analysis. The level of significance was set at $P<0.05$.

This study was conducted in accordance with the DECLARATION OF HELSINKI.

【Result】

ID was significantly higher in group E than in group Y (Group Y; 24.0 ± 1.3 cm, Group E; 25.8 ± 1.5 cm) (t = -2.39, p = 0.02) (Fig.1). PT was significantly higher in group E than in group Y (Group Y; 0.54 ± 0.41, Group E; 0.89 ± 0.38) (t=-4.33, p<0.01) (Fig.2). PO was not significantly correlated in both groups (Group Y; 0.35 ± 0.08, Group E; 0.27 ± 0.09) (Fig.2). There were no significant differences in the other measurement values.

There was a significant gender difference bias in the two groups (Group Y: $\chi 2=5.56$, df=1, p=0.02; Group E: $\chi 2=6.37$, df=1, p=0.01) (Table 2).

【Discussion】

The ID was significantly higher in Group E than in Group Y in the pelvic morphology. The posture of the elderly may also be indirectly involved in pelvic morphology. In the elderly, the activity of the transverse abdominal muscles is reduced because of the swayback posture, a common posture in the elderly[12]. The muscle power of the transversus abdominis muscle is involved in the narrowing of the anterior superior iliac spine[13]. Therefore, many elderly people in Group E with impaired transverse abdominal muscle function are more likely to develop a widening of the anterior superior iliac spine distance. In addition, more participants in this study were females. The measured parameter values for the size of the iliac auricular surface were significantly greater in males than in females[14], making pelvic alignment in females more susceptible to deformity. Therefore, the distance between the anterior superior iliac spine separates over time, even in healthy individuals. The significantly higher ID in Group E is not a finding specific to sacroiliac disorders, and can also occur in healthy individuals. Thus, ID may be a less related parameter for sacroiliac joint disorders.

The more severe the sacroiliac joint surface degeneration in sacroiliac joint disorders, the stronger the sacroiliac joint surface tilt angle[2], leading to pelvic asymmetry. PT is a parameter for pelvic asymmetry in this study. From these results, the asymmetry of pelvic morphology may be based on deformity of the sacroiliac joint and is closely related to pain. The results show that PT is significantly higher in Group E than in Group Y. The cause of the pain is most likely to occur from the degeneration of the sacroiliac joint surface[15] because of the elderly age in Group E. In contrast, Group Y had significantly lower PT than Group E. Group Y had less advanced joint degeneration than Group E, with the causes of SIJP including factors other than sacroiliac joint degeneration. In addition, pelvic asymmetry may not be the primary cause of incidence of pain in Group Y.

This study had significantly more female participants in both groups and had a higher rate of delivery experience. Pelvic girdle pain, mainly in the sacroiliac joint region, is strongly associated with SIJP, as it affects almost half of all pregnancies[15,16]. Garagiola et al. performed a computed tomography scan of the pelvis immediately after delivery and found sacroiliac joint separation in 7% of the patients and gas in the sacroiliac joint in 42% of the patients[17]. This indicates a potential change in pelvic morphology with delivery. Furthermore, the

effects of the female hormones produced during delivery contribute to malalignment of the pelvis[18,19] and pelvic instability[19]. It was not possible to determine the effect of female hormones in the present study. However, as SIJP is more common in female, changes in pelvic alignment and increased pelvic ring instability after childbirth may be involved in the development of SIJP.

【Limitation】

Pelvic ring instability and female hormones were not measured in this study. Therefore, there are limitations to the discussion regarding the relationship between SIJP and gender differences.

【Conclusion】

Pelvic morphology was not associated with SIJP, as there was no significant difference in PO. However, pelvic asymmetry was involved in SIJP in the elderly. As SIJP is significantly more frequent in females, there may be a female-specific effect on the sacroiliac joint.

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