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Reliability of Fossae Lumbales Laterales and Pelvic Incidence for Estimating Transsacral Corridors Assessed Using Reconstruction Computed Tomography

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Background: The present study aimed to evaluate the effect of fossae lumbales laterales and pelvic incidence (PI) on transsacral corridors.

Methods: Patients who underwent pelvic computed tomography (CT) during routine therapy in a single center between 2015 and 2020 were retrospectively reviewed. The patients' age and sex were documented during CT examination. Measurements were performed for both the upper and second sacral segments. Height and weight of the patients were determined using appropriate tools and body mass index (BMI) was calculated. Transsacral corridors were identified in true coronal and true sagittal planes and their width was determined as the maximum gap measured so that no screws could come out of the transacral corridors. PI was measured.

Results: Our study included 244 (57%) male and 184 (43%) female patients, who had a mean age of 49.3 ± 14.15 years (range, 18–89 years) and a mean BMI of 26.57 ± 2.38 kg/m^2. No statistically significant correlation was found between the detection of the dimple sign in physical examination and the presence of an adequate corridor. The PI was statistically significantly higher in the patients with dimples ($p < 0.001$). PI of the female patients was higher than that of the male patients ($p = 0.026$). The correlation between PI and the existence of adequate corridors for S1 and S2 screws was not statistically significant ($p = 0.858$ and $p = 0.129$, respectively). On the relationship between the presence of adequate S1 and S2 corridors where transsacral screws could be sent, an inverse relationship was detected: if the S1 transsacral corridor was adequate, the S2 corridor was inadequate or vice versa.

Conclusions: We could not obtain meaningful results on the use of the dimples of Venus or PI instead of CT to evaluate the adequacy of transverse corridors. Nevertheless, we confirmed that an increased PI was associated with the presence of dimples of Venus.

Keywords: *Dimples of venus, Back dimples, Transsacral corridor, Sacral dimple, Pelvic incidence*

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Transsacral screw fixation is performed using S1 and S2 transverse iliosacral corridors for the treatment of unilateral or bilateral U- or H-shaped sacral fractures, osteoporosis-related sacral insufficiency fractures, and posterior stabilization of non-displaced pelvic ring fractures.[1-4] Although the use of percutaneous iliosacral screws is the standard treatment for the posterior pelvic ring fixation, transsacral screws have become used more often recently, because of its increased fracture fixation strength; it provides more stable fixation of central and bilateral sacral fractures, especially in elderly osteoporotic patients.[1,2,4]

It is of great importance that transsacral screws are placed safely and effectively in order to use them. Preoperative computed tomography (CT) in the coronal, axial, and sacral planes is recommended because of the sacral anatomical variations and the presence of dysmorphism in the overall population and the need to examine the sacral anatomy in more detail.[5-7] In CT, the presence of the transsacral corridor in S1 and the corridor diameter should be evaluated. Upper sacral segment dysplasia corresponds to a sacral phenotype where upper sacral segment's dimension and orientation would not safely permit transsacral screws to pass.[5] Since the osseous corridors of upper sacral segments in the dysmorphic sacrum are narrow and angled, the risk of cortical perforation during iliosacral screw placement is higher.[8] Despite the fact that the anatomy of the upper sacrum is highly varied, a low malposition rate of iliosacral screws has been reported, provided that pelvic morphology is taken into account.[9] The most important disadvantage of CT is its high radiation rate. Up until now, no physical examination finding or a simpler imaging method indicating that there is an adequate corridor to send a transsacral screw in the pelvic morphology has been provided.

Pelvic incidence (PI) is attained by drawing a line between the femoral head and the midpoint of the sacral plateau on the sacral lateral radiograph.[10] It exhibits the pelvis width and the balance of the entire spine, and thus it helps us recognize what kind of pelvis we encounter in case of deterioration of the pelvis and the sagittal balance of the spine.[10] The PI, which was first described by Jean Legaye and Duval-Beaupere in 1998, is a constant anatomical parameter independent of the pelvis position and a reflection of pelvic morphology.[10] Pelvic parameters determine the pelvis and lumbar spinal position. The existence of abnormal spinopelvic parameters impacts the occurrence and progress of pathologies such as low back pain, lumbar disc herniation, degenerative disc disease, degenerative and isthmic spondylolisthesis, and hip osteoarthrosis.[10,11] The PI is highly correlated with radiological measurement of the sacrum.[11,12] While a large PI value corresponds to a horizontal sacrum that is anteriorly located in the pelvis sagittal plane, in contrast, a small PI value corresponds to a vertical sacrum that is high and posteriorly located in the pelvis sagittal plane.[13] Little is known about the relationship of the PI with pelvic anatomy, as well as potential anatomical determinants of its value.[10] Biomorphometric data on how the transacral corridor may change depending on the alteration of the pelvic anatomy and how the PI may affect the osseous corridors are limited.

Fossae lumbales laterales (dimples of Venus), which are considered to be hereditary, manifest themselves as symmetrical indentations on the lower back, above the gluteal cleft.[14] The dimples of Venus, a sign for the identification of the posterior superior iliac spine (PSIS) below the fascia and ligament, are formed by a short ligament that extends between the PSIS and the skin.[15] They are useful in describing the sacroiliac joint. An imaginary line uniting the hollows of both dimples passes over the second sacral vertebra's spinous process. In spinal surgery, the dimples of Venus are used as a landmark guide that identifies the upper articular surfaces of the sacrum to insert sacral pedicle screws.[16] The aims of the present study were first to find how many of the healthy pelvis specimens had a transsacral corridor at the level of S1 and/or S2 vertebrae, second to investigate whether the safe corridor for screw placement in the transsacral S1 and/or S2 corridors could be determined by any physical examination findings without the use of CT, and last to assess whether PI, which shows the differences in sacral anatomy and can be evaluated by direct radiography, could be employed for screw placement in the transsacral S1 and/or S2 corridors.

METHODS

The design of the study was retrospective. Ethical approval was obtained from the Tokat Gaziosmanpaşa University Medical Faculty Clinical Research Ethics Committee (IRB No. 22-KAEK-017). Informed consent was obtained. We obtained approval for publication from the patients whose photos were used. The patients who underwent pelvic CT scans during routine therapy in a single center between 2015 and 2020 were retrospectively evaluated. The pelvic CT scans, which had been taken while the patient was in the supine position with extension of the hip and knee joints, were examined. The patients with the age of ≥ 18 years, who allowed multiplanar reconstruction (MPR) imaging in our hospital's picture archiving and communication system (PACS), whose femoral head and pelvis were clearly assessed, and who presented to the outpatient clinic with a call for the dimple evaluation, were included in the study. On the other hand, patients with deformities such as scoliosis, spondylolysis, spondylolisthesis, those with a history of sacral, lumbar, pelvis, acetabulum, proximal femur fractures, those with a disease that disrupts the proximal femur anatomy such as developmental hip dysplasia, those who previously underwent hip surgery, those whose CT scan showed the slice thickness of > 2 mm and the presence of the sacralized lumbar element and osteolytic pelvic lesion, those with imaging without clear landmarks, and those with coxarthrosis and severe obesity (waist circumference ≥ 100 cm) were excluded from the study.

Lumbar dimple indication, height, weight, and body mass index (BMI) were determined in the patients who came to the outpatient clinic. Two study groups were formed as the patients with dimples (Fig. 1) and those with no dimples. Patients' age and sex were documented during CT examination. Measurements were performed for both the upper and second sacral segments.

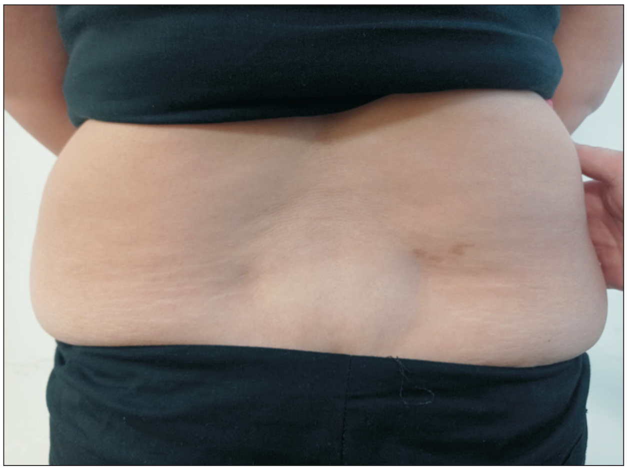

Fig. 1. Fossae lumbales laterales.

Corridor Measurements Using CT Images

The PACS software (Sectra Workstation IDS7 ver. 21.2.11.6289; Sectra, Linköping, Sweden) was used for all measurements. Figs. 2 and 3 show the craniocaudal (CC) and anteroposterior (AP) diameter measurements for the S1 and S2, respectively. Transsacral corridors in the upper sacral segment on pelvic CT images were evaluated manually using MPR. As defined by Gardner et al.[17]; the true coronal (outlet) view and true axial (inlet) view were acquired in the MPR CT images that are similar to the outlet (pubic symphysis superimposed on the S2 body) or inlet (anterior cortices of S1 and S2 superimposed) fluoroscopic views, that were obtained from the C-arm fluoroscopy device used in the operating room, and they were used for the measurement of transsacral corridor adequacy.

A diameter equal to or higher than 10 mm on both the true coronal and true axial planes, as also utilized in previous studies, was used for the cut-off values for adequate corridors.[17,18] In the first step, the pubic symphysis and sacral median crest were taken as references to find the mid-sagittal line on the CT sagittal image. A true mid-sagittal image was obtained. In the next step, the pelvic CT data were reformatted according to sacral inclination at S1 level, and the true coronal sacral plane for S1 and the true axial sacral plane in S1 were manually created with a sec-

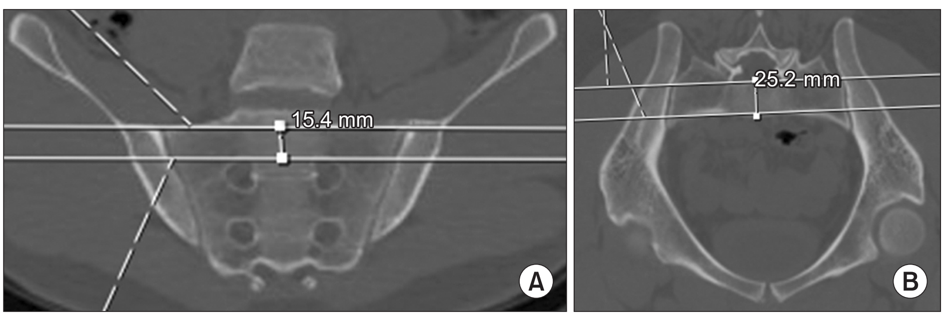

Fig. 2. Measurement of the horizontal corridor in the S1 sacral segment on reconstructed computed tomography images. (A) Craniocaudal diameter measurement in the true coronal plane (outlet view). (B) Anteroposterior diameter measurement in the true axial plane (inlet view).

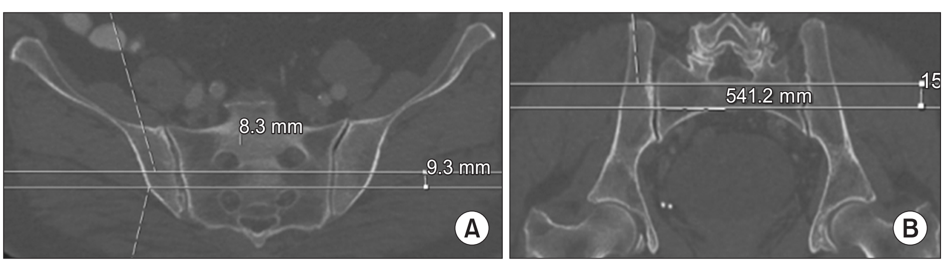

Fig. 3. Measurement of the horizontal corridor in the S2 sacral segment on reconstructed computed tomography images. (A) Craniocaudal diameter measurement in the true coronal plane. (B) Anteroposterior diameter measurement in the true axial plane.

tion volume of 1 mm. The standard axis was determined parallel to anterior cortex in mid-sagittal CT section. The reconstructed axial and coronal images were created in this axial plane parallel to the anterior cortex in the mid-sagittal view. In the true coronal and true axial images, a corridor with a maximum width was sought, avoiding screw penetration outside the intraosseous corridor. The CC diameter of S1 was measured as the vertical distance from the superior part of the first neural foramen to the deepest part of the superior cortex of the S1 segment in the vertical true coronal image. The CC diameter of S2 was measured as the maximum vertical distance from the upper part of the second neural foramen to the lowermost part of the first sacral neural foramen. The AP diameter of S1 and S2 was measured as the midalar region between the anterior and posterior cortical bones. A corridor with a width of 10 mm or greater was defined as adequate in both planes, assuming that a 6.5 or 7.3 mm screw will be inserted.

In the determination of PI, a line was drawn from the femoral head midpoint when the femoral heads overlapped or from the middle of the line linking the middle point of both femoral heads when femoral heads did not overlap to the middle point of the upper endplate of S1. PI was calculated as the angle formed between these two lines (Fig. 4). Two specialist surgeons with at least 10 years of orthopedic trauma surgery experience (EÇZ and OB) performed all measurements. To minimize the error in these measurements, both observers conducted the measurements separately and their mean was calculated.

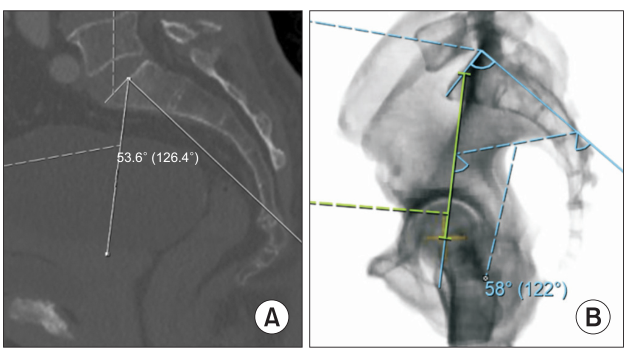

Fig. 4. The angle of sacral incidence. (A) The angle of pelvic incidence defined by the superior endplate at the mid-level of the sacral superior endplate linking the line extending from the center of the hip centers to the midpoint of the sacral endplate and the perpendicular to the center of the sacral plate. (B) The angle of sacral incidence defined as the angle between the perpendicular line drawn from the middle of the line drawn on the S1 endplate to the end plate and the line drawn from the middle of the endplate to the middle of the bicoxofemoral line.

Statistical Analysis

Quantitative data were obtained regarding the arithmetic mean and standard deviation, whereas the qualitative data were analyzed with the use of frequency distribution tables. The chi-square test was used for the comparison of qualitative variables and the independent samples *t*-test was employed to compare the continuous data between the groups. The statistical analysis was performed using IBM SPSS ver. 22 (IBM Corp., Armonk, NY, USA).

RESULTS

Our study included 244 men (57%) and 184 women (43%), who had the mean age of 49.3 ± 14.15 years (range, 18–89 years) and the mean BMI of 26.57 ± 2.38 kg/m^2. An adequate horizontal corridor to send a screw was detected in 325 patients (75.9%) for the S1 segment and in 205 patients (47.9%) for the S2 segment. No measurable horizontal corridor was found in the S1 segment of 1 patient; however, there was a measurable horizontal corridor in the S2 segment of all patients. The mean width of the S1 horizontal corridor was 14.09 ± 5.1 mm on the true coronal CT section and 15.35 ± 6.74 mm on the true axial CT section. The distribution of the quantitative variables is presented in Table 1.

The dimple sign was detected in 83 patients (19.4%). Of those with dimple signs, 45 (54.2%) were women and 38 (45.8%) were men (p = 0.021). While no dimples were detected in 268 patients, of whom screws could be sent to the S1 segment, the dimples were detected in 57 patients (p = 0.085). On the other hand, among the patients, of whom screws could be inserted, the dimples were not observed

Table 1. Distribution of Quantitative Variables

Variable	Mean ± SD	Range
Age (yr)	49.30 ± 14.15	18.00–89.00
Weight (kg)	73.73 ± 6.69	50.00–93.00
Height (m)	1.67 ± 0.04	1.53–1.98
BMI (kg/m^2)	26.57 ± 2.38	19.29–31.99
S1 craniocaudal diameter (mm)	14.09 ± 5.1	0.00–26.90
S1 AP true axial plane (mm)	15.35 ± 6.74	0.00–31.00
S2 craniocaudal diameter (mm)	11.59 ± 3.49	3.40–26.90
S2 AP true axial plane (mm)	12.84 ± 4.82	2.50–26.40
Pelvic incidence	52.86 ± 10.80	31.20–82.60

SD: standard deviation, BMI: body mass index, AP: anteroposterior.

in 162 patients while 43 patients had dimples ($p = 0.427$). There was no statistically significant correlation between the detection of a dimple sign in physical examination and the presence of an adequate corridor. PI was statistically significantly higher in the patients with dimples (Table 2).

Considering that a corridor with 10 mm or greater in diameter was defined as adequate, in men, 201 patients (82.4%) had an adequate corridor for the S1 screw placement, while 106 patients (43.4%) had an adequate corridor for the S2 screw placement. On the other hand, among women, there were 124 patients (67.4%) who had an adequate corridor to place the S1 screw, whereas 99 patients (53.8%) had an adequate corridor to place the S2 screw. The appropriate corridor for screw placement was S1 in men ($p < 0.001$) and S2 in women ($p < 0.34$), but statistical analysis result was significant in men only and insignificant in women. The correlation between the presence of dimple signs and adequate S1 and S2 corridors was found to be statistically insignificant. The PI of the women was higher than that of the men ($p = 0.026$) (Table 3). The PI

Table 2. Comparison of Demographic Data According to the Presence and Absence of the Venus Dimple

Variable	Total	Venus dimple		*p*-value*
		Present	Absent	
Age (yr)	49.39 ± 13.96	49.44 ± 13.73	49.19 ± 14.92	0.886
Weight (kg)	73.73 ± 6.69	73.9 ± 6.73	73.04 ± 6.53	0.291
Height (m)	1.67 ± 0.04	1.67 ± 0.04	1.67 ± 0.04	0.792
BMI (kg/m^2)	26.57 ± 2.38	26.64 ± 2.38	26.3 ± 2.36	0.240
S1 craniocaudal diameter (mm)	14.09 ± 5.10	14.27 ± 5.16	13.35 ± 4.81	0.140
S1 AP (mm)	15.35 ± 6.74	15.19 ± 7.21	16.01 ± 4.31	0.323
S2 craniocaudal diameter (mm)	11.59 ± 3.49	11.62 ± 3.53	11.47 ± 3.33	0.729
S2 AP (mm)	12.84 ± 4.82	12.8 ± 4.65	13.03 ± 5.49	0.692
Pelvic incidence	52.86 ± 10.8	49.06 ± 7.66	68.68 ± 6.86	< 0.001

Values are presented as mean ± standard deviation.
BMI: body mass index, AP: anteroposterior.
*Two-sample *t*-test was used.

Table 3. Comparison of Demographic Data According to Sex

Variable	Male	Female	*p*-value*
Age (yr)	48.77 ± 14.11	50.21 ± 13.75	0.291
Weight (kg)	73.5 ± 6.06	74.05 ± 7.46	0.398
Height (m)	1.66 ± 0.03	1.67 ± 0.04	0.230
BMI (kg/m^2)	26.55 ± 2.22	26.6 ± 2.57	0.833
S1 craniocaudal diameter (mm)	14.39 ± 5.09	13.7 ± 5.09	0.163
S1 AP (mm)	15.52 ± 7.22	15.12 ± 6.07	0.543
S2 craniocaudal diameter (mm)	11.42 ± 3.47	11.82 ± 3.52	0.242
S2 AP (mm)	12.72 ± 4.71	13.01 ± 4.96	0.528
Pelvic incidence	51.85 ± 9.73	54.2 ± 11.97	0.026

Values are presented as mean ± standard deviation.
BMI: body mass index, AP: anteroposterior.
*Two-sample *t*-test was used.

of the patients with dimples were statistically significantly higher than that of the patients without dimples ($p < 0.001$) (Fig. 5).

There was no statistically significant correlation between the PI values and the presence of an adequate corridor for the S1 and S2 screws ($p = 0.858$ and $p = 0.129$, respectively). On the relationship between S1 and S2 in terms of the presence of an adequate corridor, there was an inverse relationship: when the corridor was adequate for S1, it was inadequate for S2 or vice versa ($p \leq 0.001$) (Table 4). No statistically significant correlation was observed between BMI and the S1 CC diameter ($p = 0.846$, $r = 0.009$), S1 AP ($p = 0.166$, $r = 0.067$), S2 CC diameter ($p = 0.384$, $r = 0.042$), S2 AP ($p = 0.136$, $r = 0.384$), and PI ($p = 0.559$, $r = -0.028$) (Fig. 6).

When the difference in the interobserver measurements between the two surgeons was evaluated, a strong correlation was detected between the measurements of both surgeons in terms of the PI measurements ($r = 0.87$) and S1 AP true axial plane measurements ($r = 0.89$), whereas a very strong correlation was found between the measurements of both observers in terms of the S2 AP true axial plane measurements ($r = 0.90$), S1 CC diameter true coronal plane measurements ($r = 0.93$), and S2 CC diameter true coronal plane measurements ($r = 0.97$).

DISCUSSION

The dimples of Venus are a common condition. They were present in 38 men and 45 women of the total 428 patients (19.4%) included in the study. This means that their presence was observed in 1 in every 5 cases. Despite being observed so widely in the general population, the relationship of the dimples of Venus with sacrum morphology

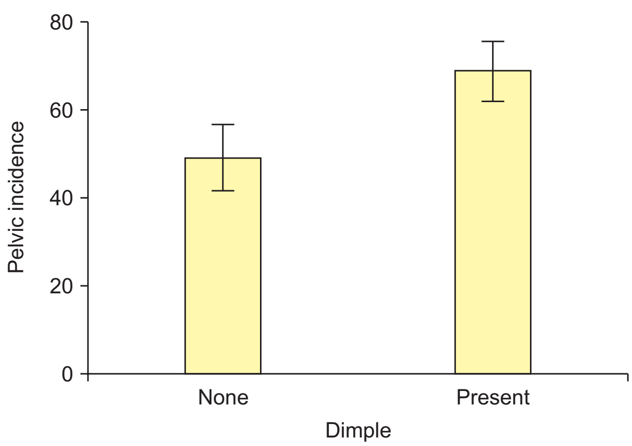

Fig. 5. Analysis of dimple and pelvic incidence relationship. Values are presented as mean ± standard deviation.

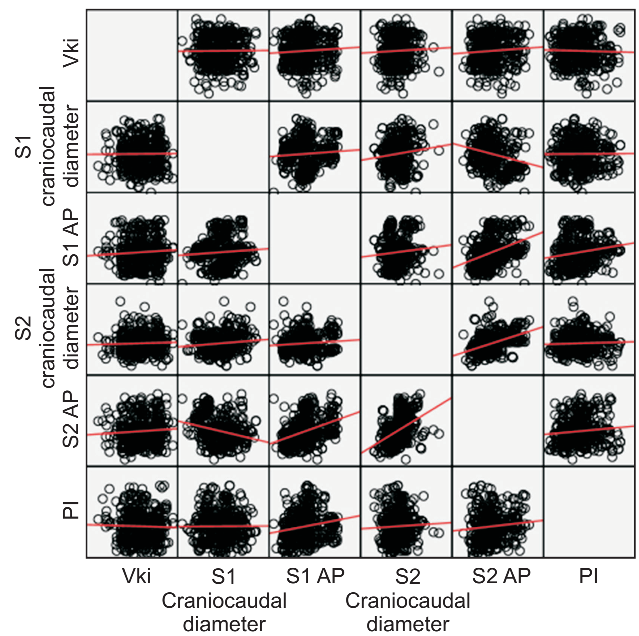

Fig. 6. Binary correlation analysis matrix scatterplot. AP: anteroposterior, PI: pelvic incidence.

Table 4. Relationship of S1 and S2 Corridor Adequacy*

Variable	S1 Screw			p-value†
	Yes	No	Total	
S2 screw				< 0.001
Yes	137 (42.2)	68 (66)	205 (47.9)	
No	188 (57.8)	35 (34)	223 (52.1)	
Total	325 (100)	103 (100)	428 (100)	

Values are presented as number (%).
*A corridor was defined as “adequate” if its diameter on both planes was 10 mm or greater. †Pearson chi-square was used. Phi coefficient: –0.204; $p < 0.001$ (inverse and significant correlation).

and whether they indicate the dysmorphic sacrum are not clear.

The sacral morphology is known to vary between individuals.[5] The PI that defines the sacrum angulation in the pelvis is a parameter of the sagittal spine profile.[10] In our study, the width of the S1 transsacral corridor highly varied in both the AP and CC planes because of the upper sacral anatomy variability. The CC diameter was lower than the AP diameter in the S1 and S2 corridors. Wagner et al.[6] stated that patients with high PI had a wider S1 transsacral corridor. In our study, in the AP plane, the relationship of the PI with both S1 and S2 transsacral diameters was significant, while that with CC diameter was insignificant.

Gras et al.[3] and Konig et al.[19] determined the adequate corridor width of S1 and S2 to be 8 mm and 9 mm, respectively, in their studies and reported that an adequate transsacral corridor was present in S1 in 64%–68% of patients and in S2 in 88%–93% of patients. In a study conducted on 526 pelvic CTs, Lee et al.[20] concluded that the transsacral S2 corridors were too small to place two screws. The discrepancies in the cited studies regarding the prevalence of transsacral S1 corridors can be attributed to the difference in the sacral regions measured for the safe zones as well.

A clear biomechanical purpose of the dimples of Venus has yet to be defined. The reason why these dimples are not seen is generally considered to be excessive fat accumulation in this region. In the literature, there are studies indicating that there is an effect of lumbar subcutaneous fat tissue thickness and increase in the BMI on the pelvis and spinal alignment.[21] The PI is a key, constant anatomical parameter allowing us to analyze the spinopelvic alignment and determine the ideal values for the patient's spinal alignment at an individual level.[22] In our study, no significant correlation was detected between the existence of the dimples of Venus and adequate transsacral corridors for screw placement. Nevertheless, the correlation between the PI value and the existence of dimples was found to be statistically significant and the reason for this was considered to be the increase in flexion in the sacrum, which facilitates the formation of dimples as the PI increases. Surgeons should take into account the complex anatomical structure of the sacrum and the interindividual variation of sacral morphology in order to safely place screws.[5,8,17,23] The transverse osseous corridor is demarked by the alar cortex anteriorly and by the sacral neural foramen posteriorly.[24] In the routine assessment of whether the sacroiliac screw can be safely placed, true coronal and true axial images, which are obtained by reconstructing CT data with millimeter slice volume and similar to fluoroscopic outlet and inlet images, are used. There are studies describing sacral dysmorphism as the non-existence of the transsacral corridor at the S1 vertebra level.[3,7] The dysmorphic sacrum assists in predicting the presence of a narrow S1 corridor and the difficulties with screw placement into the S1 segment.[17] Although many radiological signs have been described for the dysmorphic sacrum, no physical examination findings have been identified. Even in sacra that are assessed to be non-dysmorphic, in approximately 25% of cases, there may not exist a horizontal corridor that will allow a screw to be placed.[17] In a study conducted by Gardner et al.,[17] in which the same threshold values (10 mm) as in our study were used, the frequency of adequate S1 and S2 horizontal corridors was 42% and 72%, respectively. In our study, these frequencies were 68.9% and 81.2% for S1 and S2, respectively. Trikha et al.[25] investigated the presence of a safe corridor for iliosacral and transsacral screw placement in their CT-based anatomical study in the Indian population and found that the vestibule size of S2 was similar in men and women, but the size of S1 was significantly greater in men.

Gras et al.[3] evaluated the anatomy of the transsacral bone corridor with CT examination of 280 patients and reported that 89% of the patients had an adequate S1 horizontal bone corridor and that there was a correlation between a decreasing diameter of the transsacral S1 corridor and an increasing diameter of the transsacral S2 corridor. They also noted that the corridor in female patients was smaller than that in male patients and that the possibility of having sacral dysmorphism in female patients was higher than that in male patients.[3] A three-dimensional model study by Wagner et al.[9] indicated that safe placement of transsacral screws in the S1 corridor was not possible in 26%, while it was always possible in the S2 corridor. Konig et al.[19] stated that the S1-S2 interforaminal distance was smaller in women (12 mm) than in men (14 mm). Gras et al.[3,4] found that the corridor diameters of female pelves were smaller than those of the male pelves. Gardner et al.[17] investigated the screw trajectory at the S2 level in the normal and dysplastic arch and found larger S2 osseous corridors in the dysmorphic sacra. Recently, this association has been verified by demonstrating a correlation between the small S1 corridor size in sacral dysmorphism and the large diameter of the S2 corridor.[3,4] In our study, there was no adequate S1 corridor in 17.6% of the men and 32.6% of the women, and the correlation between the S1 and S2 corridors was inverse and significant. In other words, as the corridor S1 widened, S2 narrowed or vice versa. There was no significant relationship between the PI and the widths of the S1 and S2 corridors.

The PI, a measurement that is constant and unique to the individual, allows us to assess the correlation between the lumbar lordosis and pelvic orientation. Abola et at.[26] demonstrated that a more arched sacrum, reduced width of sacral ala, and a more linear joint were associated with the PI. According to studies published in the literature, the mean PI ranged between 41.5 and 54.7.[10,12,13,26] The PI has been stated to be higher in Caucasians and lower in Asians.[27-30] Studies examining the difference between the sexes regarding the PI have shown that the PI in women are higher than that in men.[27,31] The results obtained in our study, in which the mean PI was 51.85 ± 9.73 in men, 54.2 ± 11.97 in women, and 52.86 ± 10.8 in all patients, are consistent with those in the literature.

The small sample size and absence of comparative data are limitations of this study. Optimally, a comparative study with a large sample size is needed to identify morphological differences in ethnicity. Since most of the patients in our cohort were of Turkish ethnic origin, a comparative study was not able to be conducted. Besides, due to the inability to obtain the individual patient data and the differences in measuring apparatus and cut-off values, it was not possible to statistically compare the results obtained in our study with those presented in other studies. As the CT scans of the patients were collected in the supine position, the PI was the only parameter of the assessed sagittal spinal balance.

Since morphological characteristics of the sacrum, such as size and shape, are complex and show high inter-individual variation, we are of the opinion that inserting transsacral implants for the treatment of posterior pelvic lesions is still challenging and that further investigations are needed to precisely describe the terms, sacral dysmorphism and dysplastic sacrum. Confirming the adequacy of the transverse corridor to send a sacroiliac screw currently requires the use of CT. Therefore, CT is necessary to confirm the adequacy of a transverse corridor to send a sacroiliac screw. In the present study, we studied whether the dimples of Venus or PI can be used instead of CT in the assessment of the adequacy of transverse corridors; however, we could not offer promising results. Nevertheless, the presence of the dimples of Venus was closely associated with increased PI.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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