

Radiomorphometric Study of Adult Hip in the Population of Uttar Pradesh**Rajkumar¹, Sumit Kumar², Namrata Singh³, Priyanka Yadav⁴, Chandramani Yadav⁵**¹Tutor, Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur, U.P²Assistant Professor, Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur, U.P³Tutor, Department of Anatomy, Autonomous State Medical College Kanpur Dehat, U.P⁴Tutor, Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur, U.P⁵Statistician cum Tutor, Department of Community Medicine, Autonomous State Medical College, Firozabad, U.P

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Conflict of interest: Nil

Abstract:**Objective:** The objective of the study is to determine the bilateral inconsistency in the mean value of acetabular angle, modified tonnis angle, lateral centre edge angle in both male and female.**Background:** The Acetabular angle is formed between line 1 and line 2. 'Line 1' between point A at most lateral bony margins of the acetabulum to 'point B' at inferior tip of pelvic tear drop. And 'line 2' is the extension of horizontal line (Hilgenreiner's line) connecting the inferior tips of the both pelvic tear drop.**Subjects:** This study was conducted on 384 X-Ray images of patients (195 males and 189 females).**Methods:** All the measurements were done using X-Ray images with the help of Wipro Digital Radiography System.**Result:** Mean value of AA angle on right hip was 36.662° within (SD: 2.9143) in male, 36.77249° within (SD: 3.029305) in female. And on left hip was 37.2° (SD: 2.693252355) in male and 36.91005° (SD: 2.916817) in female. The right side of Acetabular angle is increase in females than in males and the left side of acetabular angle is increase in males than in females.**Conclusion and discussion:** Variations in the radiological morphology of hip joint between present study and previous studies may be due to different populations. Our analysis showed most of our morphological parameters within normal range.**Keywords:** Acetabular angle, Modified tonnis angle, Lateral center edge angle.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

The sixth week of development, chondrocytes have started to produce the lower extremity's bones and hyaline cartilage modal. In the cartilaginous condensations, where cell death generates the joint cavity, the hip joint develops when chondrogenesis is suppressed. [1] One for the ilium appears during the second month of intrauterine life, one for the ischium appears during the third month of intrauterine life, and one for the pubis appears during the fourth month of intrauterine life. [2] On the femoral head, the thickness of the articular cartilage is greatest anterolaterally. Ilium, ischium, and pubis are located at the triradiate cartilage, which makes up the acetabulum. The transverse Acetabular ligament connects the fibrocartilaginous acetabular labrum. Iliofemoral, pubofemoral, ischiofemoral, transverse acetabular, and ligamentum teres are the ligaments that support the hip joint. [3] Congenital dislocation has the

symptom of being unable to abduct the thigh. Eight times more girls than boys are impacted by this. [4]

the most prevalent condition affecting the hip joint in adults is osteoarthritis. It produces pain in the hip joint itself, stiffness brought on by the pain, and deformities such as flexion, adduction, and external rotation brought on by muscle spasms. [5,9] Femoroacetabular impingement involves a number of anatomical changes that may be connected to chondral or labral lesions, followed by secondary osteoarthrosis. [6]

The presence of a modified Tonnis angle more than 12 degrees allowed for the diagnosis of acetabular dysplasia in adults. [7,10] One of the main causes of early degenerative osteoarthritis of the hip is residual acetabular dysplasia, which results from the reduction of developmental dysplasia of the hip. [8,11]

Materials and method

This is cross sectional study and it is conducted in the Department of Anatomy and the Department of Radiology at Rama Medical College Hospital & Research Centre, Kanpur, Uttar Pradesh. This study is conducted on 384 X-Ray images of patients (195 males and 189 females) between ages of 20 years to 60 years.

Inclusion and Exclusion criteria

Both genders are included in the pelvis radiograph and Patients with features of the normal hip on both sides are the inclusion criteria. Acetabular and femoral fracture and total hip arthroplasty are the exclusion criteria.

Measurements

Acetabular angle- The angle is formed between line 1 and line 2. 'Line 1' between point A at most lateral bony margins of the acetabulum to 'point B' at inferior tip of pelvic tear drop. And 'line 2' is the

extension of horizontal line (Hilgenreiner's line) connecting the inferior tips of the both pelvic tear drop. (Fig1)

Modified tonnis angle (acetabular roof angle of tonnis)-The modified tonnis angle is formed between line 1 and line 2. 'Line 1' is the horizontal line touches the highest point H1 and H2 at the superior curvature of the femoral head. 'Line 2' from 'point A' at lateral edge of acetabulum to 'point B' marked at medial margin of acetabulum touch to line 1. (Fig2)

Lateral center edge angle (Wiberg angle)

Mid Point of femoral head –a circle draw at the circumference of femoral head. 'O' is the center of the circle where three diameters intersect between two endpoint of circle AB, CD & DE. Lateral center edge angle is formed between points 'XOY'. Point 'X' at lateral edge of acetabulum, point 'O' at mid-point of circle, and point 'Y' at highest point of sourcil or roof of acetabulum. (Fig 3)

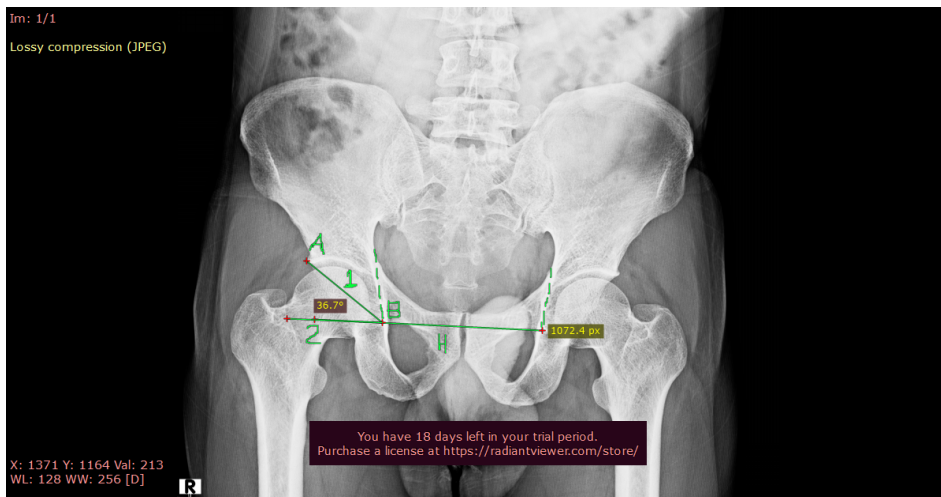


Figure 1 Acetabular angle

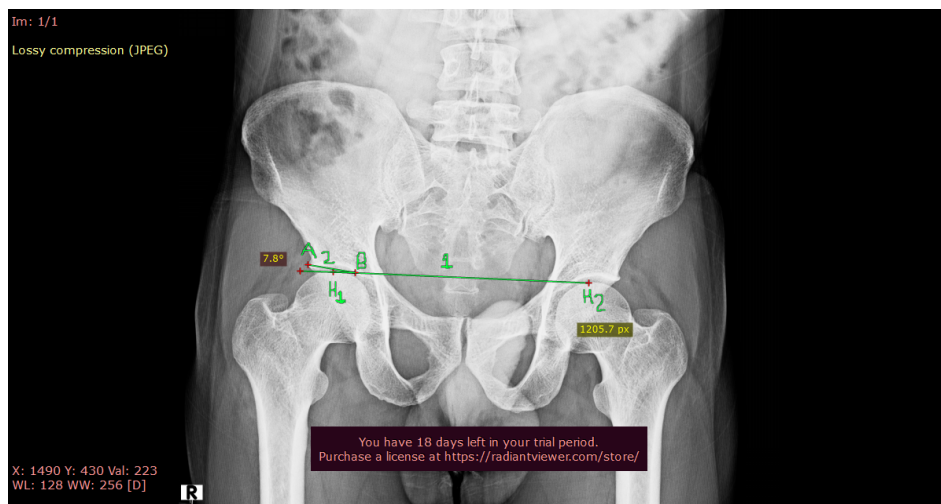


Figure 2: Modified tonnis angle

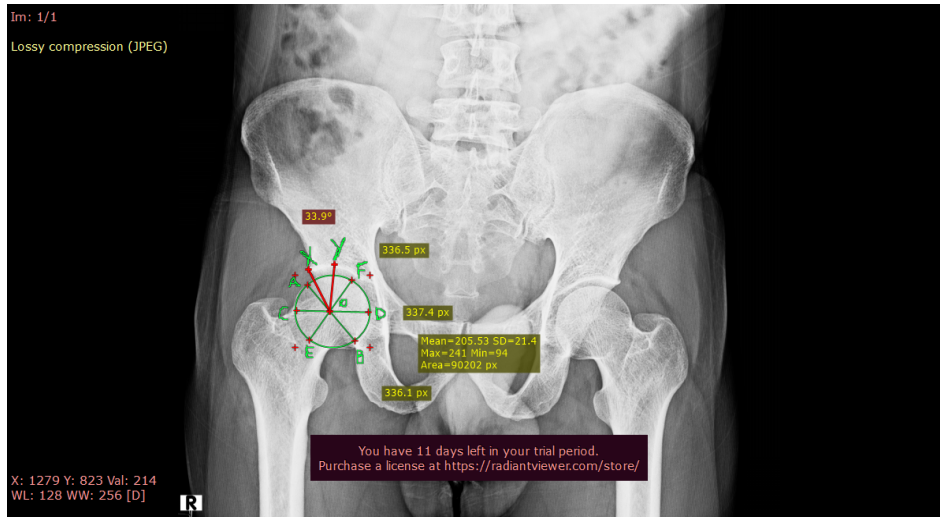


Figure 3: Lateral center edge angl

Results & observation

Table 1: Showing the range of all parameters in male and female.

| Parameters | Sides of HIP Joint | Male | Female |
|--|--------------------|-----------|-----------|
| Acetabular angle (AA) (in degree) | Right | 24 -42 | 30-46 |
| | Left | 29-40 | 28-44 |
| Modified tonnis angle (mTA) (in degree) | Right | (-8) - 9 | 0-11 |
| | Left | (-1) - 11 | (-7) - 11 |
| Lateral center edge angle (LCEA) (in degree) | Right | 28-45 | 26-42 |
| | Left | 27-42 | 22-43 |

The range of acetabular angle found on the right hip (24°to 42°) in males, (30°to 46°) in females, and on the left hip (29°to 40°) in males, (28°to 44°) in the female, normal range of AA angle: 33°to 38°.

The range of modified tonnis angle found on right hip (-8° to 9°) in male, (0° to 11°) in females and

on the left hip (-1° to 11°) in males, (-7° to 11°) in female, normal range of mTA: 0° to 12°.

The range of Lateral center edge angle found on the right hip (28° to 45°) in males, (26° to 42°) in females and on left hip (27° to 42°) in males, (22° to 43°) in female, (normal range of LCEA: 25° to 40°). (Table -1)

Table 2: This table showing the measurements of all parameters in hip joint, separately in both Genders

| Male | | | | |
|---------------------------|-------------|-------------|-------------|-------------|
| Parameters (in degree) | Mean | | SD | |
| | Right | Left | Right | Left |
| Acetabular angle | 36.662 | 37.2 | 2.9143 | 2.693252355 |
| Modified tonnis angle | 3.897435897 | 4.035897436 | 2.470390342 | 2.595345475 |
| Lateral center edge Angle | 36.805 | 37.32820513 | 2.8526 | 2.968038395 |
| Female | | | | |
| Acetabular angle | 36.77249 | 36.91005 | 3.029305 | 2.916817 |
| Modified tonnis angle | 4.17989418 | 4.439153439 | 2.160924248 | 2.531241249 |
| Lateral center edge Angle | 36.49735 | 36.86243386 | 2.444325 | 2.717578005 |

The mean value of AA angle on right hip was 36.662° within (SD: 2.9143) in male, 36.77249° within (SD: 3.029305) in female. And on left hip was 37.2° (SD: 2.693252355) in male and 36.91005° (SD: 2.916817) in female.

While mean value of mTA on right hip was 3.897435897° (SD: 2.470390342) in male, 4.17989418° (SD: 2.160924248) in female. And on

left hip was 4.035897436° (SD: 2.595345475) in male, 4.439153439 (SD: 2.531241249). Consequently, mean value of LCEA on right hip was 36.805° (SD: 2.8526) in male, 36.49735° (SD: 2.444325) in female.

And on left hip was 37.32820513° (SD: 2.968038395) in male, 36.86243386 (SD: 2.717578005) in female. (Table-2)

Table 3: Calculate the P value and T-test in the both gender.

| Parameters | P- Value | T-Test |
|---------------------------|----------|--------|
| Acetabular angle | 0.0108 | 2.5611 |
| Modified tonnis angle | 0.0666 | 1.8393 |
| Lateral center edge angle | 0.0003 | 3.6255 |

The prevalence (P) and paired T-Test in two groups right and left including both genders was calculated:- In AA angle; the p-value was found to be 0.0108 and (t-test, 2.5611). While, in modified tonnis angle was found to be 0.666 (t-test, 1.8393) and in LCEA was found 0.0003 (t-test, 3.6255). (Table-4)

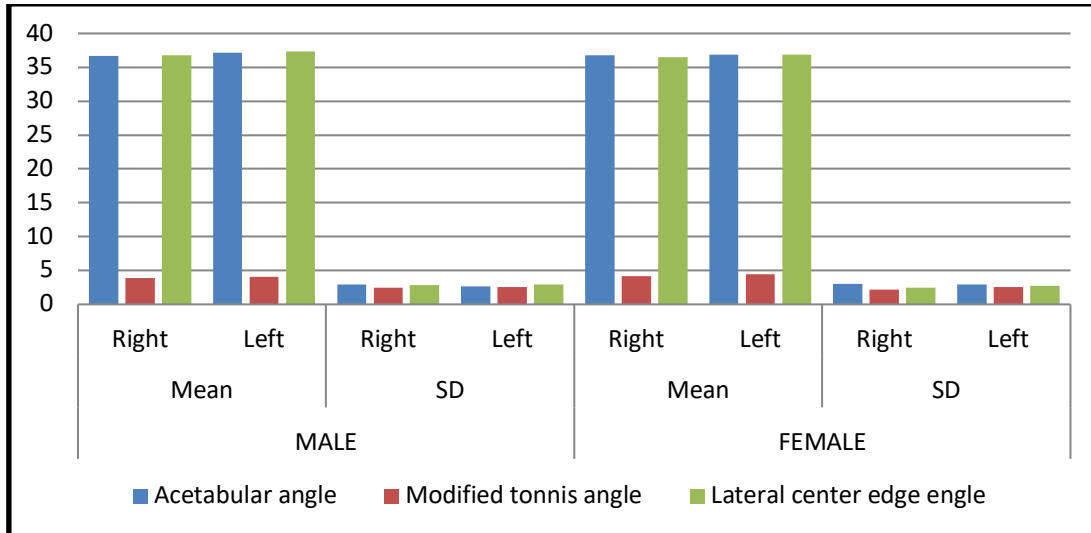


Figure 4: The measurements of hip joints

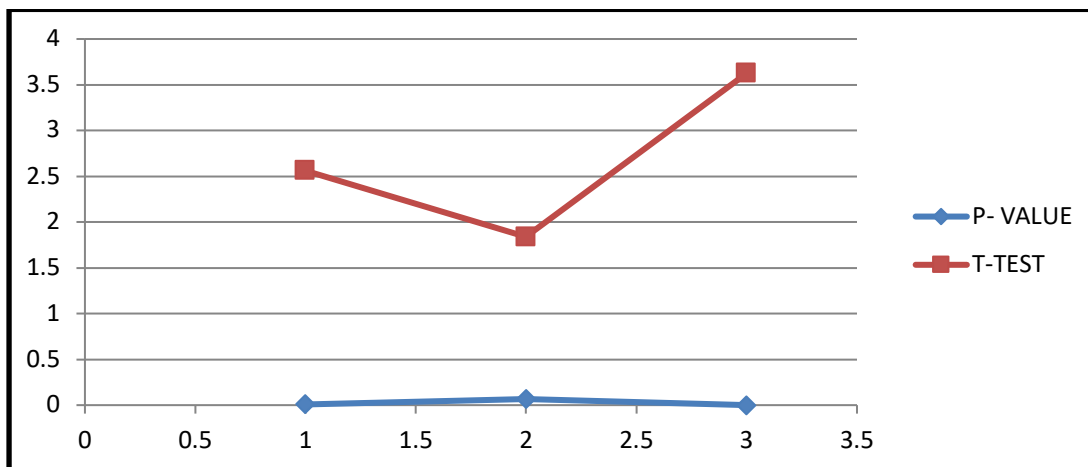


Figure 5: Scattered plot of p value and t test

Discussion

Bagwala Juzer et.al. Described range (32.67±11.67°). And in since 2008 study conducted by Okano Kunihiko et.al. Described range (-13 to 38) of right hip and (-21 to 50) of left hip. Hence, range of mTA found on right hip (-8° to 9°) in male, (0° to 11°) in female and on left hip (-1° to 11°) in male, (-7° to 11°) in female. Whereas in 2014 study conducted by Fa Liangguo et. al. described interval being estimated to be -6.39° to 11.73°. The diagnosis of acetabular dysplasia could be made when a modified tonnis angle was >12°. In this study, mean value of AA angle on right hip were found 36.662° (SD: 2.9143)

in male & 36.77249° (SD: 3.029305) in female. And on left hip was 37.2° (SD: 2.693252355) in male and 36.91005° (SD: 2.916817) in female. Whereas Sahin Seda et.al. (2016) described mean AA values with SD 38.55° ±5.28° in male and 39.55°±5.32° in female.

In AA angle; the p-value was found to be 0.0108. Whereas Sahin Seda et.al. (2016) obtained 0.37 and Umer Masood et.al. (2009) obtained 0.013. In mTA Angle; the p-value was found 0.0666. Whereas Fa Liangguo et.al. (2014) obtained p value of tonnis angle <0.001. In LCEA; the p-value was found to be 0.0003 whereas Umer M et.al. (2006) described p-value 0.01.

Conclusion

The acetabular angle was higher compared to normal AA angle, modified tonnis angle was negative compared to the normal range, while LCEA was at borderline compared to the normal range. There was radiographic evidence of lateralization and no more dysplastic values in our population.

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