


# Prevalence of Radiographic Signs of Femoroacetabular Impingement in Asymptomatic Patients and Non-Athletes\*

## *Prevalência de sinais radiográficos de impacto femoroacetabular em indivíduos assintomáticos e não atletas*

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### Abstract

**Objective** Femoroacetabular impingement has been described as an anatomical variation of the proximal femur and/or acetabular rim, impinging the hip joint. A portion of the population asymptomatic in the hip may present radiographic changes from femoroacetabular impingement. The aim of the present study was to evaluate the prevalence of these signs in asymptomatic and sedentary males.

**Methods** This was a clinical, observational, primary, cross-sectional, controlled study. A total of 32 male volunteers aged between 18 and 40 years, asymptomatic in the hip and sedentary, were selected from a university hospital orthopedic emergency room. All patients underwent standard anteroposterior pelvic radiographs. The measurements of the alpha angle, the retroversion index, the ischial spine signal, and the posterior wall sign were analyzed.


**Results** The mean age was 29 years (18-40 years old). The prevalence of radiographic signs of femoroacetabular impingement using an alpha angle of 67° was of 53.1%; with an alpha angle of 82°, it was of 31.2%. The mean alpha angle was 67° (52.4-88.2°), with 35.9% of the hips classified as borderline and 6.3% as pathological. The mean alpha angle for the right side was 67.5° (52.5-88.2°), and, for the left, it was 66.6° (53.1-86.9°). The mean retroversion index was 0.048 (right side: 0.044; left side: 0.052). The spine signal was positive in 15.6%, and the posterior wall sign, in 20.3% of the cases.

**Conclusion** This study showed that the prevalence of radiographic signs in a population of asymptomatic and sedentary adult men was high (31.2%). New studies are required to explain the actual clinical significance of this finding.

### Keywords

- femoroacetabular impact
- hip
- hip injuries

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## Resumo

**Objetivo** O impacto femoroacetabular foi descrito como uma variação anatômica do fêmur proximal e/ou da borda acetabular, que provoca impacto na articulação do quadril. Uma parcela da população assintomática quanto ao quadril pode apresentar alterações radiográficas de impacto femoroacetabular. O objetivo do estudo foi avaliar a prevalência desses sinais em indivíduos do sexo masculino assintomáticos e sedentários.

**Métodos** Estudo clínico, observacional, primário, transversal, controlado. Foram selecionados 32 voluntários masculinos, de 18 a 40 anos, assintomáticos quanto ao quadril, sedentários, atendidos em um Pronto-Socorro de Ortopedia de Hospital Universitário. Todos fizeram radiografias anteroposteriores da pelve padronizadas. Foram analisadas as medidas de ângulo alfa, índice de retroversão, sinal da espinha isquiática e sinal da parede posterior.

**Resultados** A média de idade foi de 29 anos (18–40). A prevalência de sinais radiográficos de impacto femoroacetabular com o uso do ângulo alfa de  $67^\circ$  foi de 53,1%; com o ângulo alfa de  $82^\circ$ , essa prevalência foi de 31,2%. A média do ângulo alfa foi de  $67^\circ$  (52,4–88,2°): 35,9% dos quadris foram classificados como limítrofes, e 6,3%, como patológicos. A média do ângulo alfa para o lado direito foi de  $67,5^\circ$  (52,5–88,2°), e, para o esquerdo,  $66,6^\circ$  (53,1–86,9°). O índice de retroversão médio foi de 0,048 (lado direito: 0,044; lado esquerdo: 0,052). O sinal da espinha foi positivo em 15,6%, e o da parede posterior, em 20,3% dos casos.

**Conclusão** O presente estudo demonstrou que a prevalência de sinais radiográficos numa população de homens adultos, assintomáticos e sedentários foi elevada (31,2%). O real significado clínico desse achado ainda carece de novos estudos.

## Palavras-chave

- impacto femoroacetabular
- quadril
- lesões no quadril

## Introduction

Femoroacetabular impingement (FAI) was described by Ganz et al (apud Volpon<sup>1</sup>) as a result of an anatomical variation of the proximal femur (neck-head transition) and/or the acetabular rim that impinges the hip joint, mainly during extremes of movement, possibly causing labral and joint cartilage lesions.<sup>1–4</sup>

Classically, three basic types of impingement are described: the cam type (deformity at the femoral neck-head transition), the pincer type (increase in acetabular coverage), and the mixed type (combined alterations).<sup>5,6</sup>

However, a portion of the hip-asymptomatic population can present radiological alterations consistent with FAI, and the clinical significance of this remains unclear.<sup>2</sup> In the Brazilian literature, FAI reports are scarce. As such, the present study aims to evaluate the prevalence of radiological signs of FAI in male hip- and pelvis-asymptomatic individuals cared for at the emergency room of a university hospital.

## Material and Methods

This was a clinical, observational, primary, cross-sectional, and controlled study developed at a single center and approved by the Ethics in Research Committee of the local institution under CAAE number 54363516.4.0000.5505. The Strobe checklist guided the methodology.<sup>11</sup> A total of 32 hip-asymptomatic and sedentary male volunteers, aged between

18 and 40 years, were examined at the Orthopedics Emergency Room of a university hospital.

The exclusion criteria were the presence of radiological alterations, such as hip osteoarthritis, femoral head osteonecrosis, sequela from childhood hip diseases, and sequela from pelvic, acetabular or proximal femur fractures, as well as technically inadequate radiographs.

The following information was registered: current age and presence of standardized anteroposterior pelvic digital radiography (supine position, inferior limbs in a  $15^\circ$  internal rotation, and X-ray tube at 120 cm from the patient and centered 1 cm above the pubic symphysis).<sup>7</sup>

## Radiological Evaluation

The following radiological parameters were evaluated: alpha angle, retroversion index, ischial spine signal and posterior wall sign. The radiological analysis was performed by an orthopedist and a radiologist, both with more than five years of experience in the musculoskeletal area and blinded as to the group of origin of the subjects; the measurements were made using the Horos software.

The alpha angle values were quantitatively evaluated and then characterized as normal ( $< 69^\circ$ ), borderline (between  $69^\circ$  and  $82^\circ$ ) and pathological ( $> 82^\circ$ ).<sup>7</sup>

The retroversion index, a quantitative expression of the crossing sign,<sup>8</sup> was registered in both groups, as well as the presence or absence of ischial spine and posterior wall signs.

In order to validate the alpha angle and retroversion index values with the Horos software, the intra- and interobserver correlation coefficient was initially measured. Two measurements from the 50 first radiographs available in the software were performed with a 21-day gap between evaluations. The interclass coefficient was 0.85 for the alpha angle, and 0.91 for the retroversion index. The intraclass coefficient ranged from 0.90 to 0.96 between examiners for the alpha angle, and from 0.97 to 0.98 for the retroversion index.

## Statistical Analysis

The Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, US), version 20, the Minitab (Minitab, Inc., State College, Pennsylvania, US), version 16, and the Microsoft Excel (Microsoft Corp., Redmond, WA, US), version 2010, software were used. The descriptive data were expressed as means, medians and standard deviations. The variables were compared with the two-tail Student *t* test. Values of  $p \leq 0.05$  were considered statistically significant, and the confidence interval was set at 95%.

## Results

The study enrolled 32 male individuals (64 hips) with an average age of 29 years (ranging from 18 to 40 years old). The prevalence of radiological signs of FAI using the alpha angle cut-off point of  $67^\circ$  was of 53.1% (17 controls; 28 hips). On the other hand, using an alpha angle cut-off point of  $82^\circ$ , the prevalence was of 31.2% (10 controls; 18 hips).

The alpha angle ranged from  $52.4^\circ$  to  $88.2^\circ$ , with an average value of  $67^\circ$ . A total of 23 (35.9%) hips were deemed borderline, and 4 (6.3%) were pathological, and corresponded to the cam type. Hips were defined as borderline with values between  $69^\circ$  and  $82^\circ$ , and as pathological with values  $\geq 83^\circ$ , as shown by Gosvig et al.<sup>8</sup>

Regarding hip laterality, the average alpha angle on the right side was  $67.5^\circ$ , ranging from  $52.5^\circ$  to  $88.2^\circ$ , and with a standard deviation of 8.4. On the left side, the average alpha angle was  $66.6^\circ$ , ranging from  $53.1^\circ$  to  $86.9^\circ$  ( $p = 0.251$ ).

The mean retroversion index was 0.048, with a maximum value of 0.35. Comparatively, the average value at the right side was 0.044, and at the left side, 0.052, with  $p = 0.121$ .

Comparing the distribution of the spine signal, 15.6% (10 hips) were positive. Regarding the posterior wall sign, however, the obtained value was even higher: 20.3% (3 hips) were positive.

## Discussion

The present study showed a prevalence of 31.2% of FAI radiological signs among the asymptomatic population analyzed using the cut-off normality point of  $82^\circ$  for the alpha angle. This prevalence can be considered elevated, since it is lower than the one obtained by Diesel et al<sup>7</sup> and Gosvig et al<sup>8</sup> in other studies; the use of an alpha angle value considered pathological may explain this figure.

The exact etiology of FAI is yet to be determined, but the disease is a common cause of hip pain in the young popula-

tion (Samora et al.<sup>9</sup>), and potentially leads to osteoarthritis of the hip. Concern about FAI is increasing, and the diagnosis can be challenging.<sup>4</sup>

A high proportion of the asymptomatic population presents radiological alterations consistent with FAI. The clinical value of these findings is still debatable, as well as the accuracy of the radiological signs, especially for pincer evaluation, which is being questioned in several studies. Bellaiche et al<sup>10</sup> demonstrated a poor correlation between the crossing sign at the frontal radiography and the acetabular version verified at the magnetic resonance arthrography. Wassilew et al<sup>11</sup> compared the crossing sign and the posterior wall sign in X-rays and computed tomography scans, and found that radiography had lower sensitivity and specificity. Lastly, Diaz-Ledesma et al<sup>12</sup> only observed a correlation between the acetabular retroversion index and the intraoperative chondral lesion, except when considering the crossing, ischial spine and posterior wall signs isolatedly. Since this is a study of prevalence in asymptomatic individuals, we deemed inappropriate to request computed tomography and/or magnetic resonance imaging scans due to the radiation dose and the cost of the procedures.

## Conclusion

The prevalence of radiological signs in an adult male population of asymptomatic and sedentary subjects was elevated (31.2%). The actual clinical significance of this finding requires further studies.

### Conflicts of Interest

The authors have none to declare.

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