



ORIGINAL ARTICLE

Acetabular–epiphyseal angle and hip dislocation in cerebral palsy: A preliminary study[☆]

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PALABRAS CLAVE

Parálisis cerebral;
Luxación de cadera;
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Abstract

Objective: To relate, in non-ambulatory subjects with palsy, Reimers' migration percentage with standardized radiological measurements, including the acetabular–epiphyseal angle.

Method: Descriptive, observational and transversal study of 15 individuals with cerebral palsy at levels IV and V of the Gross Motor Function Classification System, aged between 3 and 9 years. Radiological measurements of the acetabular index, Hilgenreiner's epiphyseal angle, acetabular–epiphyseal angle, neck-shaft angle and Reimers' migration percentage of each of the hips were performed.

Results: Correlations between acetabular index, epiphyseal angle and acetabular–epiphyseal angle were obtained with respect to the Reimers migration percentage. For hips with a migration rate of 15% or less, a positive correlation was observed between acetabular and epiphyseal angles.

Conclusions: In our population, the measurement between acetabular and epiphyseal inclination represents the highest association with the hip migration percentage.

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Ángulo acetábulo-epifisario y luxación de cadera en la parálisis cerebral: Estudio preliminar

Resumen

Objetivo: Relacionar, en sujetos con parálisis cerebral no deambulantes, el porcentaje de migración de Reimers con medidas radiológicas estandarizadas, incluyendo el ángulo acetábulo-epifisario.

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Método: Estudio descriptivo, observacional y transversal de 15 individuos, de edades comprendidas entre 3 y 9 años, con parálisis cerebral, pertenecientes a los niveles IV y V del *Gross Motor Function Classification System*. Se realizaron medidas radiológicas del índice acetabular, el ángulo epifisario de Hilgenreiner, el ángulo acetábulo-epifisario, el ángulo cérvico-diafisario y el porcentaje de migración de Reimers de cada una de las caderas.

Resultados: Se obtuvieron correlaciones entre el índice acetabular, el ángulo epifisario y el ángulo acetábulo-epifisario respecto al porcentaje de migración de Reimers. Para las caderas con un porcentaje de migración igual o menor del 15% se observó correlación positiva entre los ángulos acetabular y epifisario.

Conclusiones: En nuestra población, la medida entre la inclinación acetabular y epifisaria es la que mayor asociación presenta con el porcentaje de migración de la cadera.

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Introduction

For the coxofemoral joint to develop adequately it is necessary that the femoral head is sitting perfectly centered in the acetabulum, and there is a balanced growth both between the triradiate and acetabular cartilages.¹ In this sense, the vertical pressure forces of the spinal column are transmitted through the sacroiliac joints toward the hip bones, and then toward the coxofemoral joints² influencing the distribution of the trabecular bone system. This way, the trabecular pattern of the proximal femur corresponds with the lines of mechanical force,³ with a main trabecular pattern containing tensile (cervicocephalic, or Gallois' and Bosquette's arched cephalic bundle) and compressive bundles (cephalic fan-shaped bundle).⁴ Both the morphology and direction of the cephalic and cervicocephalic bundles reveal to us the transfer of tensions toward the hip while shaping and giving inclination to the femoral epiphysis. Similarly, the angle that exists between the head and the neck with respect to the femoral diaphysis allows us to assess the transfer of tensions caudally. Finally, since the trajectory of the force lines occurs through the acetabulum (sacrocytoid trabeculae),⁴ the acetabular roof line is also indicative of the direction of mechanical compression at that level. Therefore, since both tensions and compressions define the external and internal structures (trabecular system), there are measures that can be used to guess the direction of the tensions withstood by the coxofemoral joint (Fig. 1).

When it comes to the inclination of the femoral epiphysis, traditionally the Hilgenreiner epiphyseal angle (HEA) has been considered a good prognostic indicator of the anomalies occurring during the development of the proximal femur.⁵ When it comes to the angulation of the acetabular roof, the most widely used measure is the acetabular index (AI).⁶

However, although such measures show the inclination of the acetabulum and the epiphysis, separately, the assessment of the angulation between the two—the acetabular–epiphyseal angle (AEA) is not standardized.

Lastly, in order to measure the degrees of femoral neck with respect to the diaphysis, the cervical–diaphyseal angle (CDA) is commonly used.⁷

In individuals with neurological alterations, above all, cerebral palsy, the hip is one of the joints most commonly affected associating coxofemoral alterations in the gross

motor function, and a high percentage of non-ambulatory subjects with cerebral palsy (levels IV and V of the Gross Motor Function Classification System [GMFCS]⁸) have luxations and subluxations.⁹

That is why to be able to quantify the stability of the hip in this population, although the CDA is sometimes used, the radiological measure most widely used is Reimers' hip migration percentage (MP) that measures the lack of coverage of the femoral head by the acetabulum.¹⁰

However, although such radiological measures are relevant when monitoring hip alterations, they are not definitive¹¹ since, in most cases, these alterations progress fast and their etiology is complex.

For all these reasons, these are the goals of this study:

- Correlate the AI, HEA, and CDA with the MP in individuals with cerebral palsy categorized at levels IV and V of the GMFCS.
- Correlate the MP with a proposed measure – the AE in the aforementioned population.

Material and methods

Participants and design

This is a descriptive, observational, transversal study. The sample was taken from the total of school children from the Purísima Concepción Center of Special Education in Granada, Spain who used to attend regularly to physical therapy.

The inclusion criteria were a diagnosis of child cerebral palsy, being categorized as level IV or V of the GMFCS, and having one radiological study of bilateral hips in the antero-posterior projection conducted in the decubitus supine position during the last year. The exclusion criteria were having another diagnosis, being categorized in a different GMFCS group of the ones specified in the inclusion criteria, and not having a recent radiological study. This way the sample included 15 individuals, all of them of ages between 3 and 9 years old.

In order to control the possible inter-observer variation, the presence of four professionals was requested who reached the maximum possible consensus in their

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