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Review

Analysis of spinal curvatures of bone spine and of damage of the lumbar spine in rugby players (XV). Development of a method using the DXA scans☆

Analyse des courbures de la colonne vertébrale et des atteintes du rachis lombaire chez le joueur de rugby à XV. Mise au point d'une méthode utilisant la DXA

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Abstract

The DXA is currently used for the medical monitoring of weight class sports (judo, wrestling) or with weight requirement such as rugby (follow-up of fat and lean mass). We used a DXA (advantages: relatively low cost and low exposure to radiations) to detect bone spine morphotypes and particularly to measure the pelvic incidence and detect certain anatomical abnormalities of the lumbar spine. Thirty-three rugby players from the training centre of the AS Montferrandaise were studied during the 2009–2010 season. The DXA measures the composition of the body, bone mineral density, and spine morphology in order to determine the effects of both training and nutrition. It also helps to establish specific training programmes adapted to the spine morphology and, when necessary, to the anomaly revealed during the scan.

Keywords: DXA scan; Rugby; Spine anomalies; Spine morphotypes

Résumé

Dans le suivi médical des sports avec catégories de poids (judo, lutte) ou exigences pondérales comme le rugby (suivi de la masse grasse et de la masse maigre), la DXA est utilisée. Cet examen peu couteaux et très faiblement irradiant nous a semblé utilisable pour dépister les morphotypes rachidiens, et en particulier mesurer l'incidence pelvienne, ainsi que pour dépister certaines anomalies anatomiques du rachis lombaire. Nous avons étudié 33 joueurs de rugby du centre de formation de l'A.S. Montferrandaise au cours de la saison 2009–2010. La DXA permet de mesurer les paramètres biométriques, densitométriques et morphologiques et donc d'évaluer les effets de l'entraînement et des programmes nutritionnels. Elle permet également de programmer un entraînement spécifique en fonction de la morphologie rachidienne ou en cas d'anomalie dépistée lors de cet examen.

Mots clés : DXA ; Morphotype ; Rachis ; Rugby

1. Introduction

Rugby is expanding with European and International competitions and national championships, which increases the number and rhythm of the matches. Elite athletic sport requires intensive training and many mechanical constraints. Repeated, monotonous physical exercises are necessary and carry an increased risk of skeletal-muscle injuries that can lead to architectural disorders of the growing organism in young

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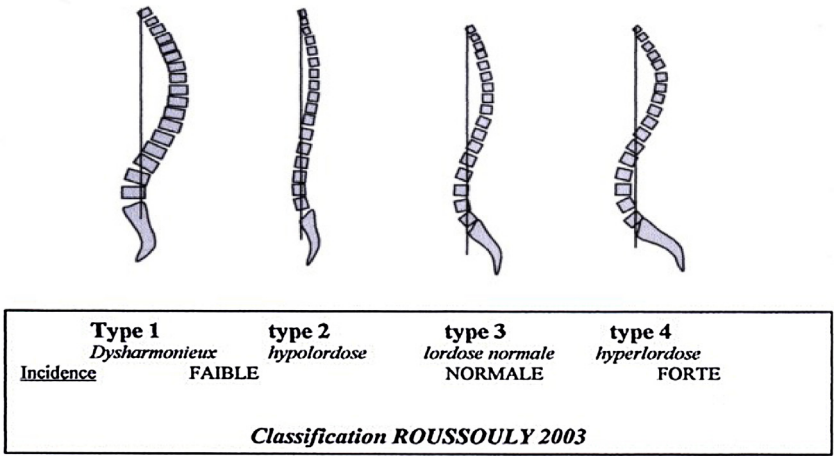

Fig. 1. Roussouly's classification. Type 1 : dysharmonious, type 2: hypolordosis, type 3: normal lordosis, type 4 hypolordosis; Incidence: low, normal, strong.

athletes. Study of 62 case reports of young players inscribed in elite performance schedules show significant spinal injuries, whether cervical or lumbar [1]. Epidemiological studies [1] show spinal injuries in 8.9% of rugby accidents, 43.4% of which in the lumbar region. In the InVS [2] report, no reference is made concerning the spine. Wei Liu [3] in a survey of the AS Montferrandaise (ASM) over one year and in 312 case reports of rugby injuries found 9% of spinal damage, half of which concerned the lumbar region. It has also been shown that damage to the lumbar spine [4] increases after a certain volume of training with a U-curve from sedentary to intense activity.

In rugby XV, we presently have no data published on adolescents, apart from the work of Bergé on the degradation of the cervical spine in rugby. This early damage to the spine raises the question of screening, prevention and sport prognosis. The potential sequellae are related to the initiation, or not, of initial treatment and rehabilitation following the early diagnosis in this phase of spine growth. This is why it is interesting to search for predisposing factors of these degenerative injuries and to use non-invasive imaging techniques with little radiation that study the whole of the skeleton, weighted if possible, so as to screen for subjects at risk.

The use of dual-energy x-ray absorptiometry (DXA) in the biometrical monitoring of weight class sports (notably fat mass) and with heavy demands on muscle mass, such as rugby or judo, has become a monitoring element. We feel that it is also important to simultaneously add the analysis of the spine morphotype with the DXA-IVA.

2. Review of the literature

Roussouly et al. [5] conducted a radiographic analysis of the spinopelvic balance and the positioning of the global gravity axis of 39 ruby players from two teams, one professional, and the other semiprofessional. The results were compared with a control population of 160 young, asymptomatic volunteers. They noted that all the positional spinal and pelvic parameters were increased in rugby men and even more so in the professional players. The pelvic incidence (PI) was increased in all the sportsmen and it even appeared to increase with the level of performance with, consequently, a greater sacral slope (SS) and more pronounced lordosis [6]. Comparison of a cohort of elite athletes with a control population was also analysed by Wodecki [7]. He found a reduction in the thoracic kyphosis and an increase in lumbar curvatures, of the SS and of the pelvic incidence. Spines at risk were classified on gymnastics by Ebermeyer in Saint-Étienne (Congress of the French federation of gymnastics in Saint-Étienne, 2009). Ebermeyer underlined the disharmony of the lumbar curves, with an increased risk of injury when the angulation of the lower vertebrae is focalised on the last vertebrae (Roussouly type 1) (Fig. 1). In such cases, he recommends a specific programme of preparation [8]. Auvinet [9] summarises the functional and anatomical risks for the lumbar spine in cavaliers.

3. Pelvic parameters

Two positional parameters, SP° and the pelvic version (VP°) can be measured on a view of the profile of the weighted pelvis with superposition of the femoral heads. The VP and SP angles are positional parameters, varying according to the sagittal inclination of the pelvis [10,11] (Fig. 2).

The SP corresponds to the angle formed by the sacral plate with the horizontal and VP corresponds to the angle formed by the vertical and the line joining the centre of the sacral plate and the centre of the axis of the femoral heads. They are linked by an anatomical parameter specific to each individual, but are constant at the end of growth, parameter called Duval Beaupère's IP°. The IP angle is a morphological parameter specific to each individual. With a simple geometrical construction, one can see that the incidence is equal to the sum of SP and VS (Fig. 3).

It is also, by projection, the angle formed by the perpendicular at the centre of the sacral plate and of the right joining the centre of the sacral plate and the bifemoral axis.

Since the incidence is constant, when SP increases, VP decreases and inversely. Furthermore, it has been shown that whatever the position of the person, standing, sitting or lying down [12], the incidence is constant.

The IP, specific to each individual, varies in a normal asymptomatic population to the order of 52° (ranging from 35° to