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CASE STUDY

The effects of a global postural reeducation program on an adolescent handball player with isthmic spondylolisthesis☆

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Abstract This report describes and evaluates a physical therapy intervention in a 15-year-old male handball player with low grade isthmic spondylolisthesis and associated spinopelvic misalignment (shear–stress type). Upon examination, increased lumbar lordosis, horizontal sacrum and anterior pelvic tilting were mainly associated with altered resting length and extensibility of the iliopsoas, hip adductors and erector spinae muscles. The intervention was directed at improving the muscles resting length and extensibility balance within a global postural alignment perspective (global postural reeducation). After the treatment period, lumbar lordosis, sacral slope and anterior pelvic tilting decreased 17.2°, 16.5° and 15.1° respectively. Global postural reeducation was effective in changing spinopelvic alignment related to low grade isthmic spondylolisthesis. This treatment option should be considered as a potential nonsurgical alternative for this condition.

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Introduction

Low grade isthmic spondylolisthesis is found in up to 50% of athletes with persistent back pain. Its overall prevalence is 4–5% in children at the age of 6 and this number rises to approximately 6% by the age of 18. 75% of all individuals showing spondylolysis or stress fracture of the pars interarticularis on plain radiographs by the age of 6 also show evidence of a slipped vertebra at that time (Fredrickson et al., 1984). The incidence of spondylolysis is higher in sports that require repetitive lumbar hyperextension and/or rotation, such as gymnastics and throwing sports (Watkins and Watkins, 2010; Wimberly and Lauerman, 2002). Halvorsen et al. (1996) found a higher occurrence of spondylolisthesis/spondylolysis in handball players between 15 and 19 years old. The etiology is not totally understood. However, lumbar hyperlordosis appears to play an important role in the development of the isthmic defect, because the repetitive lumbar hyperextension, combined with anatomical characteristics of young athletes (thinner pars, immature isthmus, and diminished resistance to disc shear), results in a high concentration of forces at the pars interarticularis (Ikata et al., 1996; Sairyo et al., 1998). This frequently is the most affected structure, although the pedicle or articular process may also be impaired (Watkins and Watkins, 2010). The vertebral slip occurs when the facet joints are unable to support the anterior shear–stress, causing isthmic spondylolisthesis (Herman et al., 2003). The most affected segment is L5–S1, because the position of the sacrum creates anterior shear and compressive forces that increase the tensile forces on the spinal ligaments and shear forces on the neural arch (Alexander, 1985; Swärd et al., 1989).

Imaging techniques can clarify the diagnosis and assist in the clinical decision. First line imaging consists of plain radiographs (frontal and lateral views) of the lumbar spine and pelvis in the upright standing position. The radiographs show the amount of vertebral slip (or slip grade, usually expressed in percentage of slip) and the alignment of the lumbar spine and pelvis (spinopelvic alignment). Even though the slip grade is essential for assessing the severity of the deformity, over the last decade several publications have furthermore stressed the value of spinopelvic alignment for the assessment and management of L5–S1 spondylolisthesis. Accordingly, proper sagittal alignment of the spine should be considered along with spondylolisthesis in order to help prevent slip progression and adjust the biomechanics of the lumbosacral region (Bourghli et al., 2011; Kim et al., 2011; Labelle and Mac-Thiong, 2011; Labelle et al., 2008, 2011; Mac-Thiong and Labelle, 2006; Sevrain et al., 2012).

Spinopelvic alignment refers to morphological and positional (postural) parameters of the spine and the pelvis that can be measured on radiographs by a number of metric or angular parameters. It is comprised of three components, one morphological, the pelvic incidence (PI), and two positional, the sacral slope (SS) and the pelvic tilting (PT). PI refers to the sacropelvic morphology (anatomy) specific to each individual, which is unaffected by changes in human posture. It will remain the same whether the subject is standing, sitting or lying down, assuming that there is no significant motion occurring at the sacroiliac joints or deformation of the sacral plate (Labelle and Mac-Thiong, 2011). SS and PT measure the sacropelvic orientation in the sagittal plane. SS is the angle between the sacral plate and the horizontal line. The orientation of the sacral plate is the base of the lumbar spine thereby determining its sagittal orientation ($r^2 = 0.646$), i.e., the lumbar lordosis (LL) (Boulay et al., 2006). PT represents the spatial orientation of the pelvis, which varies according to position, with a greater or lesser degree of anterior or posterior tilting in relation to a transverse axis passing through the two femoral heads. PI, SS, and PT are all interrelated as PI represents the arithmetic sum of the PT and SS angles ($PI = SS + PT$). PI is an important determinant of the spatial orientation of the pelvis in the standing position: the greater the PI, the greater has to be SS, PT, or both have to be. As the value of PI is fixed for a given patient, the sum of PT and SS is likewise invariable, so as one increases, the other decreases (Labelle and Mac-Thiong, 2011; Le Huec et al., 2011a; Mac-Thiong et al., 2007; Vaz et al., 2002).

Postural alignment exercises, stretching and manual therapy are often recommended to change LL and PT, improve abnormal motion patterns and the range of motion (ROM) of the lumbopelvic region, and reduce pain and disability associated with impairments of the lumbar spine (Bonetti et al., 2010; Chaitow, 2006; Gajdosik et al., 1994; Halpin, 2012; Kendall et al., 2005; Kisner and Colby, 2002; Liebenson, 2007; Sahrmann, 2002; Scannell and McGill, 2003). However, to the best of our knowledge, the effects of conservative interventions on spinopelvic alignment parameters (PI, PT, SS and LL) have not been investigated yet. In this report we describe a global postural reeducation program and evaluate its impact on spinopelvic alignment, slip grade and mobility of the lumbar spine of a young athlete with low grade isthmic spondylolisthesis.

Case description

The patient was a 15-year-old male Caucasian handball player (height = 1.73 m; body mass = 59.0 kg; body mass index = 19.7 kg/m^2), who was referred to physical therapy with a medical diagnosis of low back and buttock pain and grade II L5–S1 isthmic spondylolisthesis, lumbar hyperlordosis and verticalization of the sacral plate. Informed consent was obtained and the rights of the patient were protected.

History and presentation

The patient fell on his lower back during a handball game in April 2011, which triggered acute low back and buttock pain accompanied by stiffness. He was assisted just after the fall, was told to rest, take painkillers and put ice on the injured area. Over the following days, the team's medical staff examined him and decided to investigate further using X-ray scans (15-04-2011). The radiographs revealed a grade II L5–S1 isthmic spondylolisthesis (radiologist diagnosis). The patient continued to take painkillers and was told to stop playing handball until the pain disappeared and that he would be reevaluated some months later to check the