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How the type of sagittal alignment defined by Roussouly determines the gait of the asymptomatic adult subject

Comment le type d'alignement sagittal défini par Roussouly détermine la marche du sujet adulte asymptomatique

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While curvatures of the sagittal spine are known to greatly differ among asymptomatic adult subjects, there are no studies that determine whether this heterogeneous normality affects gait. This study aimed to elucidate the relationships between normal sagittal spine profiles and gait in asymptomatic adult subjects. Ninety-one asymptomatic adult subjects (age = 21.6 ± 2.2, 47 M & 44F) with no prior orthopedic treatment underwent full body biplanar X rays with 3D reconstruction of the spine and pelvis. The following sagittal spino-pelvic parameters were generated from the 3D reconstructions: pelvic incidence, sacral slope, pelvic tilt, L1-L5 lordosis, L1-S1 lordosis, T1-T12 kyphosis and T4-T2 kyphosis. Lower limb kinematics was assessed using 3D gait analysis. Each subject was classified into one of the 4 types of normal sagittal alignment previously described by Roussouly. Kruskal-Wallis test was used to evaluate the differences in gait and spino-pelvic parameters between the Roussouly types.

Seventeen subjects were classified as type 2, 47 as type 3, 26 as type 4 but only 1 as type 1. Therefore, Roussouly's type 1 was excluded from further analysis. Pelvic incidence (type 2: 41°; type 3: 48°; type 4: 56°), sacral slope (type 2: 30°; type 3: 38°; type 4: 45°), L1-L5 lordosis (type 2: 38°; type 3: 48°; type 4: 54°) and L1-S1 lordosis (type 2: 50°; type 3: 60°; type 4: 67°) differed significantly ($P < 0.001$) between Roussouly types. Pelvic tilt, T1-T12 kyphosis and T4-T12 kyphosis were similar ($P > 0.05$) across the 3 types. Gait analysis revealed that type 2 subjects had the most retroverted pelvis during the gait cycle ($P = 0.02$), the most elevated hip extension during stance phase ($P = 0.02$) and the highest range of motion of ankle plantar-dorsiflexion during the gait cycle ($P = 0.01$). Types 3 and 4 subjects had similar gait patterns with decreased pelvic retroversion during the gait cycle, decreased hip extension during

the stance phase and decreased ankle plantar-dorsiflexion during the gait cycle compared to type 2 subjects. Sagittal spino-pelvic morphotypes seem to affect gait kinematics, even in asymptomatic subjects. Interestingly, different sagittal morphotypes seem to affect gait not only proximally (pelvis and hip) but also more distally (ankle). Future studies should determine whether sagittal malalignment and its surgical correction influence gait.

Disclosure of interest The authors declare that they have no competing interest.