MEETING OF THE SOCIETY FOR EXPERIMENTAL BIOLOGY

Marseille July 2008

LEARNING TO WALK MODIFIES THE WHOLE LOCOMOTOR SKELETON : BIPEDALISM AND IMPACT OF GRAVITY IN HUMANS

Loading of the skeleton and learning to walk entail drastic changes of the whole locomotor skeleton: vertebral column, pelvis and lower-limbs. We present an overview of the changes affecting this complex interarticular system, pointing out impact of growth and gravity. We looked for pelvic parameters establishing functional links with vertebral column on one hand and with lower limbs on the other hand. A major acquisition during learning to walk is the sagittal balance of the trunk above the lower limbs. We demonstrated the role of the pelvis in this balance by discovering a new sagittal pelvic parameter the “angle of sacral incidence” (mean: 54°; extreme: 35°-75°). Adequate correlations between the degree of incidence and of vertebral curves ensure an economical balance. We show the absence of sexual dimorphism for the “angle of incidence”. We present the lower values of this parameter in occasionally biped primates and its significant increase in young Japanese macaques trained for bipedalism.

During the transition from the abducted position of the lower limbs in newborns to their adducted position in adult, numerous three-dimensional modifications of the femoral axes occur. We hypothesized that the tree-dimensional orientation of the acetabula plays a role in these changes. We developed a software package, “DE-VISU”, devoted to the pelvis and applied it to 70 adult and newborn human pelves. Acetabular orientation changes during postnatal growth: acetabular anteversion increases from 3° to 20°, acetabular sphericity increases from 166° to 180°. These changes will strongly interact with those of the directional axes of the lower limbs.

Our results suggest that the pelvis is the “key-stone” of the integrated functional system linking rachis, pelvis and lower-limbs during growth.

Comparative Biochemistry and Physiology. July 2008. Annual Meeting of the Society for Experimental Biology, vol 150A, 3, 580.