BIOMECHANICAL FEMALE PELVIC FLOOR MODEL

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Computational biomechanics is an expanding field bringing new approaches to the clinical practise by addressing personalized biomechanical human body models and numerical simulations. For accelerating biomedical simulations into an everyday medical routine, we focus on injury prevention in mother and child during the second phase of the childbirth process, and to avoid pelvic floor disorders caused by the incompatible geometry of the bony pelvis and fetal size. For specific bony pelvis and fetal dimensions, pelvic floor disorders including stress urinary incontinence, urgency urinary incontinence, overactive bladder, pelvic organ prolapse, and fecal or anal incontinence are common [1].

Our work concerns a female pelvic floor biomechnical model based on the finite element method. Based on a reference MRI data of a female pelvic floor, we develop a template geometry of the gynecoid type. Besides the body pelvis forming the pelvic floor, the model consists of all major internal tissues, where the material data are taken from previous studies [2] and the boundary conditions represent tissue connections. The model is based on modular blocks that means purpose specific simulations can be performed. The model serve for modeling the second stage of the vaginal delivery, where the birth is driven by prescribed head trajectory, or for modeling the pelvic organ prolapse caused by birth related injuries. Based on the predefined landmarks on the body pelvis, the model can be morphed to any specific target model, which will serve for a female-specific injury risk prediction during and after the vaginal delivery, or for modeling pelvic floor prolapses by internal loading.

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REFERENCES

[1] J.L, Hallock, V.L Handa, The epidemiology of pelvic floor disorders and childbirth: an update. *Obstet Gynecol Clin North Am.*, Vol. **43(1)**, pp. 1-13, 2016.
[2] H. Čechová et al., Finite element modeling of max. stress in pelvic floor structures during the head expulsion (FINESSE) study. *Int Urogynecol J.*, Vol. **32(7)**, pp.1997-2003, 2021.