$p < 0.001$), and ECC (r:-0.186, $p < 0.004$). No significant associations were observed between gait speed and sway velocity across any condition, including the Romberg Quotient (RQ) and Proprioception Quotient (PQ) ($p > 0.486$ for all), except for the in ECS condition, which showed a weak negative correlation ($r = -0.149$, $p = 0.01$).

Discussion

In conclusion, both greater *sway area* across all conditions and greater *sway velocity* in ECS were associated with slower gait speed. On the other hand, gait speed was surprisingly not linked to RQ or PQ. This finding may stem from the fact that SI enables compensation for deficiencies of a sensory system in healthy older adults6. It may also be due to the absence of SI measurements in dynamic contexts, as assessing SI in static conditions may not fully reflect the demands of gait. We recommend that future research prioritize the evaluation of SI during dynamic tasks that more accurately reflect the demands of gait.

References

1. Horak, F. B., & Macpherson, J. M. (2011). Postural Orientation and Equilibrium. In Y. S. Prakash (Ed.), *Comprehensive Physiology* (1st ed., pp. 255–292). Wiley. https://doi.org/10.1002/cphy.cp120107.
2. Fitzpatrick, R., & McCloskey, D. I. (1994). Proprioceptive, visual and vestibular thresholds for the perception of sway during standing in humans. *The Journal of Physiology*, *478*(1), 173–186. https://doi.org/10.1113/jphysiol.1994.sp020240
3. Anson, E., Pineault, K., Bair, W., Studenski, S., & Agrawal, Y. (2019). Reduced vestibular function is associated with longer, slower steps in healthy adults during normal speed walking. *Gait & Posture*, *68*, 340–345. https://doi.org/10.1016/j.gaitpost.2018.12.016
4. Lord, S. R., Lloyd, D. G., & Li, S. K. (1996). Sensori-motor function, gait patterns and falls in community-dwelling women. *Age and Ageing*, *25*(4), 292–299. https://doi.org/10.1093/ageing/25.4.292
5. Yang, F., & Liu, X. (2020). Relative importance of vision and proprioception in maintaining standing balance in people with multiple sclerosis. *Multiple Sclerosis and Related Disorders*, *39*, 101901. https://doi.org/10.1016/j.msard.2019.101901
6. Diaconescu, A. O., Hasher, L., & McIntosh, A. R. (2013). Visual dominance and multisensory integration changes with age. *NeuroImage*, *65*, 152–166. https://doi.org/10.1016/j.neuroimage.2012.09.057

https://doi.org/10.1016/j.gaitpost.2025.07.132

Impact of Femoral Derotation Osteotomies on Gait, Growth Plate Loading, and Femoral Growth Trajectories in Children with Idiopathic Torsional Deformities

Willi Koller *[1], Andreas Kranzl [2], Gabriel Mindler [3], Martin Svehlik [4], Arnold Baca [1], Hans Kainz [1]

[1] *Centre for Sport Science and University Sports- University of Vienna, Department of Biomechanics- Kinesiology and Computer Science in Sport, Vienna, Austria*
[2] *Orthopaedic Hospital Speising, Laboratory for Gait and Human Movements, Vienna, Austria*
[3] *Orthopaedic Hospital Speising, Department of Pediatric Orthopaedics, Vienna, Austria*
[4] *Medical University of Graz, Department of Orthopedics and Traumatology, Graz, Austria*

Introduction

Bone growth and shape is influenced by mechanical loads experienced during daily activities such as walking. Torsional femoral deformities - defined as an increased or decreased anteversion angle (AVA) compared to healthy controls - are common, often causing pain, altered gait, and increase the risk for osteoarthritis [1]. Femoral derotation osteotomies (FDO) are used to correct these deformities, but their impact on bone loading and further growth remains unclear. Importantly, such insight is essential to determine the optimal timing and extent of correction needed for long-term benefit.

Research Question

How do FDO affect bone loads and future growth trajectories?

Methods

Three-dimensional gait analysis (3DGA) data, including marker trajectories and ground reaction forces, was recorded before (10.2 ± 8.4 months) and after (18.4 ± 14.2 months) an intertrochanteric FDO of five patients with idiopathic torsional deformities - two with increased AVA and three with decreased AVA - aged 13.4 ± 1.8 years at the surgery. Magnetic resonance images (MRIs) were recorded before the surgery. MRIs were used to quantify AVA, neck-shaft-angle, inter-epicondylar distance and tibial torsion to personalize musculoskeletal models. For the post-surgery models, AVA was adjusted based on the surgery report. Subsequently, pre- and post-surgery 3DGA data were used to calculate joint angles, muscle forces and joint contact forces (JCFs) using OpenSim [2,3]. The root-mean-square-difference (RMSD) between patients' and typically developing children' joint angles (from [4]) was quantified.

For each femur, a subject-specific finite element model was created [5]. A second model was created by virtually performing surgery on the segmented femur. Muscle and JCFs from the musculoskeletal simulations (pre- and post-FDO) were applied as nodal forces. Shear and compressive stresses in the growth plate were quantified and used to calculate the osteogenic index (OI) [6]. Subsequently, growth trends, i.e. change in AVA, were predicted based on the OI and our recently calibrated mechanobiological model [4].

Results

The RMSD of joint kinematics to healthy individuals decreased significantly in all patients from $12.4 \pm 3.4°$ to $7.9 \pm 2.5°$. The hip JCF and its orientation changed in all participants. Interestingly, the OI was very similar before and after surgery. Furthermore, the predicted change of AVA did not significantly change due to the surgery (Figure 1).

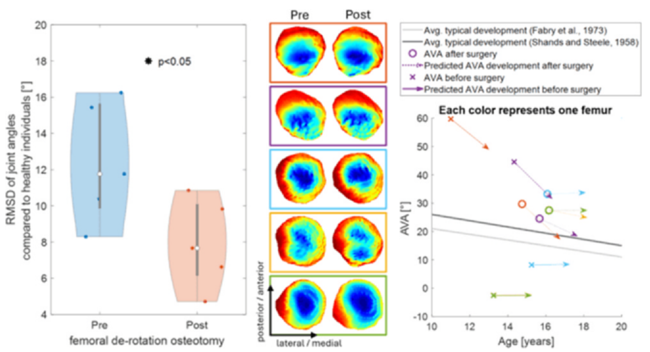

Figure 1: Left: RMSD of joint angles compared to healthy children. Middle: Osteogenic index (red = promoted growth; blue = inhibited growth) within the proximal growth plate before and after surgery. Right: Pre- and post-surgery AVA and predicted growth trajectories within the following two years. Each color represents one femur.

Discussion

This is the first study which showed how FDOs influence growth plate stresses and femoral growth trends. Our workflow can be used to select the ideal timing for the FDO and identify patients where an over- or under-correction of the AVA is required to achieve the desired long-term outcome.

References

[1] M. Scorcelletti, N.D. Reeves, J. Rittweger, A. Ireland, Femoral anteversion: significance and measurement, J. Anat. (2020) joa.13249. https://doi.org/10.1111/joa.13249.

[2] J.M. Kaneda, K.A. Seagers, S.D. Uhlrich, J.A. Kolesar, K.A. Thomas, S.L. Delp, Can static optimization detect changes in peak medial knee contact forces induced by gait modifications?, Journal of Biomechanics 152 (2023) 111569. https://doi.org/10.1016/j.jbiomech.2023.111569.

[3] S.L. Delp, F.C. Anderson, A.S. Arnold, P. Loan, A. Habib, C.T. John, E. Guendelman, D.G. Thelen, OpenSim: Open-Source Software to Create and Analyze Dynamic Simulations of Movement, IEEE Trans. Biomed. Eng. 54 (2007) 1940–1950. https://doi.org/10.1109/TBME.2007.901024.

[4] W. Koller, M. Svehlik, E. Wallnöfer, A. Kranzl, G. Mindler, A. Baca, H. Kainz, Femoral bone growth predictions based on personalized multi-scale simulations: validation and sensitivity analysis of a mechanobiological model, Biomech Model Mechanobiol (2025). https://doi.org/10.1007/s10237-025-01942-x.

[5] W. Koller, B. Gonçalves, A. Baca, H. Kainz, Intra- and intersubject variability of femoral growth plate stresses in typically developing children and children with cerebral palsy, Front. Bioeng. Biotechnol. 11 (2023) 1140527. https://doi.org/10.3389/fbioe.2023.1140527.

[6] S.S. Stevens, G.S. Beaupré, D.R. Carter, Computer model of endochondral growth and ossification in long bones: Biological and mechanobiological influences, J. Orthop. Res. 17 (1999) 646–653. https://doi.org/10.1002/jor.1100170505.

https://doi.org/10.1016/j.gaitpost.2025.07.133

Investigation of the effects of myopia and occlusion disorders on balance

Burcu Ece Korkmaz *[1], Esin Efe Güney [2], Barbaros Hayrettin Ünlü [3], Aslı Canan Yıldırım [3], Yeşim Salık Şengül [4]

[1] *Izmir University of Economics, Physical Therapy and Rehabilitation, İzmir, Turkey*
[2] *Dokuz Eylül University, Faculty of Dentistry, Izmir, Turkey*
[3] *Dokuz Eylül University, Faculty of Medicine, Izmir, Turkey*
[4] *Dokuz Eylül University, Faculty of Physical Therapy, Izmir, Turkey*

Introduction

Balance is the ability to keep the body's center of gravity vertically within the limits of the support surface. (1) The relationship of the visual system, which is one of the important subcomponents in the provision of balance, with occlusion disorders has been investigated in recent years. (2,3) Myopia, which is one of the most common refractive errors among visual system disorders, may lead to poor distance vision and increased balance problems.(4) Although it is not possible to make a clear cause-effect definition in the relationship between visual problems and malocclusions, it has been shown that malocclusions may increase the prevalence of myopia(5). Inappropriately treated myopia and temporomandibular joint occlusion disorders may cause problems in the organization of sensory inputs required for balance.

Research Question

The aim of this study was to investigate the effects of the relationship between myopia and occlusion disorders on balance.

Methods

The study enrolled 67 participants. Group1(myopia) n = 36, Group2 (control) n = 31. Myopia was evaluated using a Nidek autorefractometer device and recorded 30 minutes after cycloplegic drops were instilled into the patients.The occlusion assessment was performed by the dentist according to the Angle Classification in the sagittal plane, using a mirror and probe in the dental unit and under reflector light. Biodex Balance System was used to assess balance, and participants were evaluated with Limits of Stability (LoS) test.

Results

There was no statistically significant difference between the right (RO) and left occlusion(LO) class distributions of Group 1 and Group 2 subjects (For RO: $\chi^2(5, N = 67) = 4.04$, $p = 0.553$; for LO: $\chi^2(5, N = 67) = 4.88$, $p = 0.458$). Statistically significant differences were observed between RO and LO classes for losforward ($F = 33.34$, $p < 0.001$), ($F = 14.86$, $p < 0.001$) and losbackward ($F = 22.10$, $p < 0.001$), ($F = 11.39$, $p < 0.001$) parameters.When the relationship between the degree of right refractive error (RRE) in the right eye and left refractice error (LLE) and balance parameters was examined,