Development of an Ergonomic Backrest Based on Spinal Curvature via Polynomial Interpolation for Office Syndrome Mitigation

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Abstract

Nowadays, daily activities across all age groups—including students, working professionals, and older adults—require prolonged sitting. Poor sitting posture and chairs lacking ergonomic support can lead to chronic back pain and Office Syndrome, conditions becoming increasingly common,especially among children and adolescents. Therefore, developing chair backrests that conform to the natural curvature of the human spine is essential for preventing musculoskeletal disorders, promoting healthy posture, and supporting physical development. This project, entitled Development of an Ergonomic Backrest Based on Spinal Curvature via Polynomial Interpolation for Office Syndrome Mitigation, has two objectives: (1) to develop chair backrests that accurately match human spinal anatomy across different age groups, and (2) to reduce chronic back pain associated with Office Syndrome. The design applies the Polynomial Interpolation method to connect six anthropometric landmarks: the seat-contact point (buttocks), waist, lumbar apex, apex of the back curve, upper back, and base of the neck, creating a continuous mathematical representation of the spinal profile. Anthropometric data were compiled from NASA and WHO references and classified by gender and age groups ranging from 6 to over 60 years. The resulting spinal coordinates were refined through Point Transformation to generate ergonomic backrest profiles. The proposed approach produced smooth, accurate backrest contours, resulting in 16 mathematical backrest models. These models provide effective support for critical spinal regions, particularly the lumbar area, improving pressure distribution, reducing muscular load, enhancing sitting comfort, and lowering the risk of Office Syndrome.

Keywords: Human Spinal Curvature, Office Syndrome, Polynomial Interpolation