Dynamic Seating
Literature Review

Seating Dynamics
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The following are results of a literature review on Dynamic Wheelchair Seating. This term is used in multiple contexts. Some articles refer to dynamic seating, but are addressing changes to the seated posture during manual wheelchair propulsion. Other articles refer to dynamic surfaces or cushions that “actively redistribute pressure on the body surfaces.” (i.e. Stephen Sprigle PhD, P. T. (2011). Assessing evidence supporting redistribution of pressure for pressure ulcer prevention: a review. *Journal of rehabilitation research and development, 48*(3), 203.). Some articles refer to a seat’s “dynamic stiffness” (i.e. Garcia-Mendez, Y., & Boninger, M. L. (2012). Dynamic stiffness and transmissibility of commercially available wheelchair cushions using a laboratory test method. *Journal of rehabilitation research and development, 49*(1), 7.). This review explores literature in the context of dynamic wheelchair seating where a part of the wheelchair or wheelchair seating system moves in response to client movement.

Peer Reviewed Publications (in chronological order):

   *Pilot study investigating and characterizing the use of the two adjustable seating functions on the Elevation ultralight dynamic wheelchair during community use.*

   *Seating and Wheeled Mobility clinical applications, including Dynamic Seating*

   *Quantitative movement analysis was used to compare movement during an extensor thrust with a dynamic back and with a rigid back. Results: decreased extensor thrust, increased range of motion in anterior-posterior direction, decreased vertical trunk movement during extension and decreased upper extremity movement (reduced large UE movement).*

   *Similar to article above.*

Goal of study to determine effects of a dynamic seating system as a therapeutic intervention in children with CP. 12 children, half received static seating and half received dynamic seating. Evaluated for ROM, tone, motor function, and level of disability at initiation, 3 months and 6 months. Both groups improved.


Dynamic seating resulted in the reduction in spasticity intensity and in contact pressures, a better posture stability, a better comfort, an improvement in functional aspects, and the prevention of damages to the seating systems, and a better vocal and/or breathing ability.


*Children learn to move by moving*


*Development of a system to determine human-generated motions and forces during unconstrained extensor thrusts. Effectiveness and reliability established.*


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*Researchers observed that a thoroughly designed dynamic seating system induces a decrease in the intensity and duration of the extension pushing movement at the trunk and head level, a lesser hyperextension of the head during spasms, a lesser involvement of lower limbs, a greater consistency of anatomic parts with the components of the posture system during and after the spasm (maintenance of correct posture) , a lesser consumption of physical energies by the patient, and an improvement in swallowing and consequent reduction of saliva.*


*Development of an objective measure to quantify the degree of spasticity.*


*A method of calculating the net forces and torques on human joints using inverse dynamics and an 11 segment model of the human body.*

**Non-Peer Reviewed Publications**


   http://www.rifton.com/adaptive-mobility-blog/blog-posts/2013/may/dynamic-seating-for-children-disabilities


9. Dynamic Seating System Fact Sheet, Georgia Institute of Technology (undated).
   http://rearlab.gatech.edu/factsheetz/DSS_FactSheet_v3.pdf

**Presentations and Proceedings**


16. Samaneein, K., Greene, P., Lees, K., and Riches, P. (2013). Comparison of Imparted Forces between Rigid and Dynamic Seating Systems during Activities of Daily Living by Children with Cerebral Palsy. Congress of the International Society of Biomechanics, Brazil. *A mobile strain gauge data acquisition system was developed to capture the forces and moments in wheelchair components in a rigid and dynamic seating system. They determined the magnitude of the contact force on the backrest, footrests and center of pressure (COP) on the seat during ADLs. Footrest forces and moments varied, but back support interface forces remained the same for each system. Average force on backrest was 60-70% BW, 20% BW on each footrest. Peak forces (during extension) were 200% BW on backrest and 600% BW on footrests.*


40. Shows that a dynamic seating system may positively affect the reduction of spasticity and the increase of certain functional activities


Study found changes in hip extension force and duration using a dynamic back.

Study found improvements in function, demeanor, and reduced repairs using a dynamic back.


Design Articles


Patents


