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):

1. Furumasu, J. (2017). **Consideration when working with the Pediatric Population.** In Seating and Wheeled Mobility: a clinical resource guide. Slack, Inc., Thorofare, NJ.

https://www.healio.com/books/health-professions/occupational-therapy/%7B0494f75e-c42b-4f30-96d8-175a3fd90747%7D/seating-and-wheeled-mobility-a-clinical-resource-guide

This chapter includes clinical applications of Dynamic Seating.

2. Mattie, J., Borisoff, J., Miller, W. C., & Noureddin, B. (2017). **Characterizing the community use of an ultralight wheelchair with "on the fly" adjustable seating functions: A pilot study.** PloS one, 12(3), e0173662.

https://doi.org/10.1371/journal.pone.0173662

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

3. Adlam, T., Johnson, E., Wisbeach, A. and Orpwood, R. (2015). **Look at me! A functional approach to dynamic seating for children with dystonia.** Developmental Medicine & Child Neurology. Vol 57, pg 27.

Abstract from the European Academy of Childhood Disability 27th Annual Meeting. Design of dynamic seat with movement at ankles, hips, knees and back. Seat is instrumented to measure torque and angular displacement. The child demonstrated increased social engagement and function.

4. Wilson, P. E., Lange, M. (2014). **Seating Evaluation and Wheelchair Prescription.**
http://emedicine.medscape.com/article/318092-overview

Seating and Wheeled Mobility clinical applications, including Dynamic Seating

5. Gimeno, H., Gordon, A., Tustin, K., & Lin, J. P. (2013). **Functional priorities in daily life for children and young people with dystonic movement disorders and their families.** European journal of Paediatric Neurology, 17(2), 161-168.

Comfort is a high priority for families.

6. Novak, I., Mcintyre, S., Morgan, C., Campbell, L., Dark, L., Morton, N., ... & Goldsmith, S. (2013). **A systematic review of interventions for children with cerebral palsy: state of the evidence.** Developmental Medicine & Child Neurology, 55(10), 885-910.

Of 64 discrete interventions, 24% have been proven to be effective. There is a gap between research and practice.

7. Othman, M., Bhuiyan, N., & Kong, L. (2011). **Developing a dynamic wheelchair using the design structure matrix method.** Concurrent Engineering, 19(3), 235-243. http://journals.sagepub.com/doi/abs/10.1177/1063293X11420176

The goal of this article is to develop an instrumented, dynamic seating system for people with extensor thrust using the Design Structure Matrix (DSM) tool.

8. Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). **Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study.** American Journal of Occupational Therapy, 65(1), 76-85.

https://ajot.aota.org/Article.aspx?articleid=1853012

Vestibular input (movement) can reduce maladaptive behaviors.

9. Avellis, M., Cazzaniga, A., Cimolin, V., Galli, M., and Turconi, A.C. (2010). **Dynamic seating vs. rigid seating: A quantitative comparison using 3d movement analysis in people with cerebral palsy.** Posture and Mobility, 26(1):15–16.

(article available to members, https://www.pmguk.co.uk/journal/pmg-journal-1997-2014).

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).

10. Cimolin, V., Piccinini, L., Avellis, M., Cazzaniga, A., Turconi, A. C., Crivellini, M., & Galli, M. (2009). 3D-**Quantitative evaluation of a rigid seating system and dynamic seating system using 3D movement analysis in individuals with dystonic tetraparesis.** Disability and Rehabilitation: Assistive Technology, 4(6), 422-428.

https://doi.org/10.3109/17483100903254553

Full access version: http://www.r82.co.uk/media/417996/fumagalli_research_dynamic_v_rigid.pdf

Study:

This study was done by Fumagalli in Italy. Quantitative movement analysis using 3D kinematics and pressure distribution was used to compare movement during an extensor thrust with a dynamic back and with a rigid back in ten people with cerebral palsy and dystonia. An R82 x:panda seating system was used.

Results:

Participants experienced decreased extensor thrust forces, increased range of motion in the anterior-posterior direction (the client could move their trunk forward and back), decreased vertical trunk movement during extension (shear) and decreased upper extremity movement (reduced large UE movement and increased smoothness of movement). The authors concluded that this could lead to increased occupant comfort (decreased pain) and quality of postural stability.

11. Hahn, M. E., Simkins, S. L., Gardner, J. K., & Kaushik, G. (2009). **A dynamic seating system for children with cerebral palsy.** Journal of Musculoskeletal Research, 12(01), 21-30.

https://www.worldscientific.com/doi/abs/10.1142/S0218957709002158

Study:

The goal of this study was to determine the effects of a dynamic seating system (movement at hips and knees) as a therapeutic intervention in children with cerebral palsy. The study included twelve children: half received static seating and half received dynamic seating. Each child was evaluated in the areas of range of motion, muscle tone (Modified Ashworth Scale), motor function (Gross Motor Function Measure), and level of disability (Pediatric Evaluation of Disability Inventory) at initiation, 3 months and 6 months. A Kids Rock wheelchair was used.

Results:

Both groups improved in motor function (particularly in Sitting and Crawl/Kneel) and level of disability (self-care, mobility, social function). The authors concluded that a larger, more homogeneous group would likely show significant differences in muscle spasticity, gross motor function and disability. Trends showed a decrease in spasticity, an increase in range of motion and improvement on the GMFCS (Gross Motor Function Classification System) for crawling and walking.

12. Van Geffen, P. (2009). **Dynamic Sitting.** Thesis. Institute for Biomedical Technology, Enschede. Amsterdam, The Netherlands.

https://www.xsens.com/wp-content/uploads/2014/01/Dynamic_Sitting_PhD_Thesis_vanGeffenP.pdf

Development of a simulator that allows independent adjustment of trunk, pelvis and thighs to improve posture.

13. Pfeiffer, B., Henry, A., Miller, S., & Witherell, S. (2008). **Effectiveness of Disc 'O'Sit cushions on attention to task in second-grade students with attention difficulties.** American Journal of Occupational Therapy, 62(3), 274-281.

https://ajot.aota.org/pdfaccess.ashx?url=/data/journals/ajot/930095/274.pdf

Dynamic cushion demonstrated increased attention and alertness in response to movement.

14. Mcnamara, L., & Casey, J. (2007). **Seat inclinations affect the function of children with cerebral palsy: a review of the effect of different seat inclines.** Disability and Rehabilitation: Assistive Technology, 2(6), 309-318.

https://www.tandfonline.com/doi/abs/10.1080/17483100701661314

Relationship of seat inclination and postural control.

15. Crane, B. A., Holm, M. B., Hobson, D., Cooper, R. A., & Reed, M. P. (2007). **A dynamic seating intervention for wheelchair seating discomfort.** American Journal of Physical Medicine & Rehabilitation, 86(12), 988-993. https://journals.lww.com/ajpmr/Abstract/2007/12000/A_Dynamic_Seating_Intervention_for_Wheelchair.5.aspx

Study:

The objective of this study was to examine the effectiveness of an experimental dynamic wheelchair seating system designed to relieve discomfort for long-duration wheelchair users. The study used the Tool for Assessing Wheelchair discomfort (TAWC). Two wheelchair users each tested an initial design and feedback guided the development of a second design.

Results:

The study found that dynamic seating reduced spasticity intensity and contact pressures, improved postural stability, increased comfort (decreased pain), improved function, prevented damage to the seating system, and increased vocal and/or breathing ability.

16. de Graaf-Peters, V. B., Blauw-Hospers, C. H., Dirks, T., Bakker, H., Bos, A. F., & Hadders-Algra, M. (2007). **Development of postural control in typically developing children and children with cerebral palsy: possibilities for intervention?** Neuroscience & Biobehavioral Reviews, 31(8), 1191-1200. https://www.sciencedirect.com/science/article/pii/S0149763407000486

Children learn to move by moving.

17. P. Incoronato: **Dynamic seating for children and adults with multiple disabilities.** Orthopedic technology. 2/2007, 92-97. https://www.tib.eu/de/suchen/id/tema%3ATEMA20070300132/Dynamische-Sitzversorgung-f%C3%BCr-Kinder-und-Erwachsene/

Study:

This Retrospective study of the Aktivline dynamic seat occurred in Germany.

Results:

The study found that children and adolescents could sit longer, felt less pain, and demonstrated improved posture, joint mobility, and digestion.

18. Kitchen, J. (2006). **Design of Wheelchair Seating Systems for Users with High-Tone Extensor Thrust.** Thesis. 08/2006. Georgia Institute of Technology.

http://www.mobilityrerc.gatech.edu/publications/kitchen_james_p_200608_mast.pdf

19. VP Patrangenaru: **Development of a dynamic seating system for high-tone extensor thrust.** Thesis. 05/2006. Georgia Institute of Technology.

https://smartech.gatech.edu/handle/1853/10438

An analytical dynamic model of a human subject undergoing an extensor thrust on a rigid chair was created. A Dynamic-Hingeback Seating System was also developed. Desired motion of the system occupant during extensor thrust was verified.

20. Hong, S. W., Patrangenaru, V., Singhose, W., & Sprigle, S. (2006). **A Method for Identifying Human-Generated Forces during an Extensor Thrust.** International Journal of Precision Engineering and Manufacturing, 7(3), 67.
http://www.r82.co.uk/media/418002/hong_etal_methodidentifyingforces_clinbiomechanics2006_smarttechversion.pdf

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

21. Hong, S. W., Patrangenaru, V., Singhose, W., & Sprigle, S. (2006). **Identification of human-generated forces on wheelchairs during total-body extensor thrusts.** Clinical Biomechanics, 21(8), 790-798.
https://www.sciencedirect.com/science/article/pii/S0268003306000751

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

Similar to article above.

22. P. Incoronato (2006). **Dynamic Seating: Characteristics, Indication and Efficacy.** Orthopedic Technique 4/2006, 282-285.

https://www.tib.eu/en/search/id/tema:TEMA20060405082/Dynamische-Sitzversorgung-Eigenschaften-Indikation/

Study:

This Retrospective study of the Aktivline dynamic seat also occurred in Germany.

Results:

This study showed reduction of pain and improvement of movement control of the upper extremities, trunk, and head.

23. Ferrari A. (2003). **"In terms of posture and postural control (In tema di postura e di controllo posturale)"**, Giornale Italiano di Medicina Riabilitativa, 17 (1); 61-74.

(link unavailable)

Study:

This study was conducted in Italy.

Results:

Researchers observed that the use of a thoroughly designed dynamic seating system decreases intensity and duration of extension at the trunk and head, decreases hyperextension of the neck during spasms, decreases extension of the lower limbs, maintains body alignment with the components of the posture system during and after spasms, conserves energy consumption, and improves swallowing and, as a result, reduces drooling.

24. P. Incoronato: **Use of dynamic seating shells in Dynamic Seating for children and adults with infantile cerebral palsy and after brain injury.** Physiotherapy journal for physiotherapists. 5/2002, 764-769.

http://www.physiotherapeuten.de/pt/archiv/2002/kg05/a_kg07.html

25. Engsberg J.R., Olree K.S., Ross S.A., Park T.S. (1996). **Quantitative clinical measure of spasticity in children with cerebral palsy.** Archives of Physical Medicine and Rehabilitation 77, 594-599.

https://www.archives-pmr.org/article/S0003-9993(96)90301-9/pdf

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

26. Hutchinson, E. B., Riley, P. O., & Krebs, D. E. (1994). **A dynamic analysis of the joint forces and torques during rising from a chair.** Rehabilitation Engineering, IEEE Transactions on, 2(2), 49-56.

https://ieeexplore.ieee.org/document/313146/

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

1. Eason, S. (2015). **Enhancing Development with Dynamic Wheelchair Components.** Directions, (4), 50-52. http://www.nrrts.org/directions/2015%20vol%204/DIRECTIONS_2015.4_RehabCaseStudy.pdf

2. Freney, D. and Schwartz, K. (2015). **Dynamic Seating.** Directions, (4), 45 – 48. https://www.seatingdynamics.com/wp-content/uploads/2016/02/Directions2015-4-ClinicalCorner.pdf

3. Samaneein, K. (2014). **Biomechanical comparison of a rigid and dynamic seating system for children with special needs** (Doctoral dissertation, University of Strathclyde). http://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.605962

4. Deyo-Obler, L. (2013). **Dynamic Seating and Pelvic Positioning Blog**

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

5. Watanabe, L. (2011). **Keeping Kids in Motion: defining dynamic seating & determining the benefits.** Mobility Management.
https://mobilitymgmt.com/Articles/2011/02/01/Keeping-Kids-in-Motion.aspx

6. Sturgeon, J. (2010). **Dynamic Seating Poised to Move Mobility Market Forward.** Mobility Management.
https://mobilitymgmt.com/articles/2010/05/05/dynamic-seating-tech.aspx?sc_lang=en

7. Lange, M. (2009). **Dynamic Seating: A Case Study.** Directions, (3), 44 – 46.
http://www.nrrts.org/pdfs/CaseStudies/Directions_vol5_2009_44_46.pdf

8. Watanabe, L. (2008). **Editors at Large: A.R.T. Group's Kids Rock Active Chair.** Mobility Management.
https://hme-business.com/articles/2008/01/07/editors-at-large-art-groups-kids-rock-active-chair.aspx

9. Lange, M. (2000). **Focus on…. Dynamic seating.** Occupational Therapy Practice, (5), 21-22.
(link not available)

Presentations and Proceedings

1. Lange, M. (2018). **Dynamic Seating: diffusing and moving!** Numotion webinar.
https://www.numotion.com/courses-events/webinars-on-demand/dynamic-seating-diffusing-and-moving!

2. Adlam, T. and Gimeno, H. (2018). **A Feasibility Trial of a Whole Body Dynamic Seating System for Preschool Children with Dystonia: Aims, Methods and Measures.** International Seating Symposium, Vancouver, BC. Proceedings, pgs. 111-114.
http://www.seatingsymposium.com/images/pdf/ISS2018_Syllabus_eVersion.pdf
This session presented a current feasibility trial to guide and inform the design of a full scale trial to assess acceptability and efficacy of whole-body dynamic seating on activity, participation, and quality of life in preschool children with dystonic cerebral palsy, using mixed qualitative and quantitative methods.

3. Lange, M., Pedersen, J. (2018). **Dynamic Seating**, International Seating Symposium, Vancouver, BC.

4. Lange, M. (2018). **Is Your Client Stuck? Dynamic Seating Gets Things Moving!** Travis Medical. Georgetown, TX.

5. Lange, M. (2018**). Is Your Client Stuck? Dynamic Seating Gets Things Moving!** National Seating and Mobility, Oklahoma City, OK.

6. Lange, M. (2017). **Dynamic Seating.** OccupationalTherapy.com webinar.
https://www.occupationaltherapy.com/ot-ceus/course/dynamic-seating-3530

7. Lange, M. (2017). **Dynamic Seating**, NuFair, Portland, OR.

8. Lange, M. (2017). **Dynamic Seating**, NuFair, Seattle, WA.

9. Eason, S. (2017). **Dynamic Seating to Provide Vestibular Input**. NRRTS webinar.

10. Sparacio, J. (2017). **Dynamic Components for Dynamic People**, Canadian Seating and Mobility Conference, Toronto, Canada. Proceedings, pgs 46-48.

https://www.seatingdynamics.com/wp-content/uploads/2018/01/2017-Canadian-Seating-Proceedings-Sparacio-paper.pdf

11. Lange, M., Pedersen, J., Sparacio, J., Eason, S., Sutherland, S. (2017). **Dynamic Seating – Providing Movement and Why.** International Seating Symposium, Nashville, TN.

Proceedings: https://www.seatingdynamics.com/wp-content/uploads/2017/02/ISS-2017-Proceedings-Paper-Dynamic-Seating.pdf

12. Lange, M. (2017). **Dynamic Seating**, NuFair, Salisbury, MD.

13. Lange, M. (2017). **Is Your Client Stuck? Dynamic Seating gets things Moving!** Webinar, Numotion.

https://numotion.sharefile.com/share/view/s525818a067741228

14. Adlam, T., Morris, C., McFadden, H., Dutton, A. (2016). **Designing for Dystonia: Begin at the Beginning with Children, Parents and Therapists.** International Seating Symposium, Vancouver.

Proceedings, pgs. 64-68.

http://www.seatingsymposium.com/images/pdf/2016Syllabus.pdf

At the time of this presentation, this group was designing a seating system for children ages two to five years with whole body dystonia. They were also determining the feasibility of evaluating the impact of the seat with functional outcome measures suitable for use with this group, as preparation for a subsequent trial with a group of six children. Item #2 on this list presents their progress.

15. Freney, D. and Schwartz, K. (2016). **Dynamic Seating.** Canadian Seating and Mobility Conference. Toronto. Proceedings pgs. 48-51.

http://www.csmc.ca/docs/archives/2016_archive/ws/WS26%20-%20DYNAMIC%20SEATING.pdf

16. Collin, T. (2016). **Dynamic Seating – Creating Possibilities.** European Seating Symposium.

17. Lange, M. (2016). **Dynamic Seating.** Webinar, AbleNet.

https://www.ablenetinc.com/resources/recorded_webinars?s=Dynamic+Seating&sort=&post_type=recorded_webinars.

18. Lange, M. (2016). **Dynamic Seating.** Webinar. HomeCEUConnection.

https://www.homeceuconnection.com/course/dynamic-seating/

19. Eason, S. (2016). **Dynamic Seating**. Webinar, NRRTS.

20. Lange, M. (2016). **Dynamic Seating**. NuFair, Philadelphia, PA.

21. Crane, B. (2015). **Dynamic Seating: Principles and Practices for Clients with Neurological Diagnoses, Numotion conference**, Salisbury, MD.

22. Crane, B. (2015). **Effects of Dynamic Wheelchair Seating on Pressure, Motion, and Propulsion.** International Seating Symposium, Nashville, TN. Proceedings, p. 159.

http://www.iss.pitt.edu/ISS_Pre/Iss_Pre_Doc/ISS_2015.pdf

This session presented research that was on-going and stated that long-term testing was underway. The study was testing whether the KiSS dynamic seating system impacted body motion or seat interface pressure.

Results:

Preliminary testing did not show a significant effect.

23. Pedersen, J. and Eason, S. (2015). **Using Seating to Enhance Movement of the Body in the Wheelchair.** International Seating Symposium, Nashville, TN. Proceedings pgs. 319-321.

Proceedings paper: http://www.iss.pitt.edu/ISS_Pre/Iss_Pre_Doc/ISS_2015.pdf

Recording: https://www.youtube.com/watch?v=LO4y_VeHn8k&feature=youtu.be

24. Collin, T. (2015). **Dynamic Seating – creating possibilities.** Nordic Seating Symposium, Oslo.

25. Lange, M. (2015). **Dynamic Seating** webinar, Numotion.

26. Adlam T (Designability), Orpwood R (University of B), Wisbeach A (Great OSH), Alger H (Great OSH), Johnson E (Great OSH). (2014). **Whole Body Dynamic Seating for Children with Extensor Spasms.** In: Cooper D, Story M, editors. 30th International Seating Symposium. Vancouver: Interprofessional Continuing Education, University of British Columbia. pp. 182–185.

http://seatingsymposium.com/images/pdf/2014Syllabus.pdf

This session describes the development of a novel dynamic seating system. Initial prototypes were evaluated by two children. The final prototype was then used in further studies (see items #2 and #14 above).

Results:

The following outcomes were noted: increased vocalization, increased movement, one child was able to access a switch in the dynamic seat (and unable to in their static seating), reduced spasm intensity, increased symmetry in posture, increased head control, and the onset of movement (of the dynamic seat) reduced the rate of increase of spasm. The client also expressed preference for the dynamic option.

27. Dalton (2014). **An Evaluation of a Simulated Dynamic Foot Support.** International Seating Symposium, Vancouver, BC. Proceedings, pgs. 64-67.

http://seatingsymposium.com/images/pdf/2014Syllabus.pdf

This session described an evaluation of the impact of a simulated dynamic foot support on an adult with Dystonic cerebral palsy who experiences whole body extensor spasms. This study was designed to optimize the mechanical

design of the foot support to then use in a pilot study scheduled for February 2014. It is unknown if this study occurred.

Results:

Use of the simulated foot support increased head and arm control and the client reported that it was easier to drink and swallow. It should be noted that the simulated support was provided only by the clinician's hands.

28. Lange, M. (2014). **Dynamic Seating** webinar, RESNA.

29. Lange, M. (2014). **Dynamic Seating** webinar, NRRTS.

30. 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. The research team determined the magnitude of the contact force on the backrest, footrests and center of pressure (COP) on the seat during ADLs (Activities of Daily Living). Footrest forces and moments varied, but back support interface forces remained the same for each system (static and dynamic). Average force on the backrest was 60-70% BW (Body Weight) and 20% BW on each footrest. Peak forces (during extension) were 200% BW on backrest and 600% BW on footrests.

Results:

Clients are able to exert up to 200% of their body weight against the backrest and 600% of their body weight against the footrests during extension. Dynamic seating can be used to diffuse these forces.

31. Adlam, T., Orpwood, R., Wisbeach, A. (2013). **Experiences and Research into Dynamic Seating for People with Severe Extensor Spasms.** Annual Conference Posture and Mobility Group, University of the West of England.

32. Samaneein, K., Greene, P., Lees, K., & Riches, P. (2013). **A comparison of force exerted on rigid and dynamic backrest system by children with cerebral palsy.** Paper presented at European Seating Symposium incorporating Assistive Technology, Dublin, Ireland.

33. Lange, M. (2013). **Dynamic Seating** webinar, National Seating & Mobility.

34. Doherty, J. (2013). **"Freedom" – An Overview of Functional & Therapeutic Benefits of Dynamic Seating**, International Seating Symposium, Nashville, TN. Proceedings, p. 173 – 174.

http://www.iss.pitt.edu/ISS2013/ISS2013Program/RST_CE_0125_12web.pdf

35. Samaneein, K. et al. (2012). **Assessment of forces imparted on seating systems by child with special needs during daily living activities.** In Biomedical Engineering and Sciences (IECBES), 2012 IEEE EMBS Conference, pp 475-478.

36. Samaneein, K. et al. (2012). **Assessment of Seating Forces Imparted Through Daily Activity by Children with Special Needs.** International Seating Symposium, Vancouver, BC. Proceedings, pgs. 80-83.

http://seatingsymposium.com/images/pdf/2012Syllabus.pdf

37. Eason, S. (2011). **Dynamic Seating: Why, Who, How**, International Seating Symposium, Nashville, TN. Proceedings, page 275-276.

http://www.iss.pitt.edu/iss_pre/iss_pre_doc/iss_2011.pdf

38. Lange, M. (2011). **Providing Dynamic Stability** webinar, Bodypoint.

39. Borisoff, J. F., & McPhail, L. T. (2011). **The development of an ultralight wheelchair with dynamic seating. RESNA Conference**, Toronto, Proceedings, pp. 1-4.

https://www.resna.org/sites/default/files/legacy/conference/proceedings/2011/RESNA_ICTA/borisoff-69725.pdf

Describes the Elevation wheelchair which is an ultralight rigid manual wheelchair that allows the client to adjust the seat height (posterior portion raises) and backrest recline angle. The chair weighs less than 25lbs. It is operated by 2 gas springs under the seat and a lever.

The authors define dynamic seating as "the user's ability to easily and quickly adjust their seating position independently."

40. K Samaneein and P Riches. (2011). **Development of a fully mobile, strain gauged seating system for assessment of forces imparted on the Mygo seating system by children with special needs through daily activity.** In Olwen Ellis, editor, Proceedings of the Posture and Mobility Group National Training Event, Birmingham, England.

Available on request from the author: philip.riches@strath.ac.uk / bioengineering1@hotmail.com

41. Brinks and Paleg. (2010). **Sensory Input Processing in Dynamic Seating, International Seating Symposium**, Vancouver, BC. Proceedings, pgs. 48-51.

http://seatingsymposium.com/images/pdf/2010Syllabus.pdf

Addresses microstimulation in seating systems

42. Cimolin, V. (2009). **Dynamic Seating vs. Rigid Seating: a comparison using 3D**. International Seating Symposium. Proceedings, pg. 177. (no full online Proceedings)

43. Emiliani, P. L. (2009). **Supporting Inclusion and Independence: Compliant Seating for Children with Cerebral Palsy and Whole Body Extensor Spasms.** Assistive Technology from Adapted Equipment to Inclusive Environments: AAATE 2009, 25, 52.

A case study describing a seat designed with dynamic footrests and a dynamic back. The child showed reduced muscle tone and improved head and hand control.

44. Hahn and Simkins. (2008). **Effects of Dynamic Wheelchair Seating in Children with Cerebral Palsy International Seating Symposium**, Vancouver, BC. Proceedings, pgs. 153-157.

http://seatingsymposium.com/images/pdf/2008Syllabus.pdf

Study reported a decrease in spasticity, an increase in range of motion and improvement on GMFCS,

the positive effects of the dynamic posture system in subjects with children brain paralysis when in the seated position and during daily activities.

45. Hahn, M. (2007). **Effects of Dynamic Wheelchair Seating on Spasticity and Functional Mobility in Children.** International Seating Symposium, Orlando, FL. (not in Proceedings)

46. Cooper D., Antoniuk E. (2007). **Dynamic Seating – A spectrum of applications.** International Seating Symposium, Orlando, FL., Proceedings, pgs. 87-88.

http://www.iss.pitt.edu/ISS_Pre/ISS_Pre_Doc/ISS_2007.pdf

47. Cooper D., Antoniuk E., Taylor S.J. (2007). **Dynamic Posture Control**, European Seating Symposium, Dublin (Irl).

48. Taylor, S., Seikman, A., Cooper, D. (2006). **Putting the "Dynamic" Back in Seating.** International Seating Symposium, Vancouver, BC., Proceedings, pg. 215.

http://seatingsymposium.com/images/pdf/2006Syllabus.pdf

49. Hong, Patrangenaru, Singhose, Sprigle. (2005). **Motion Measurement and Force Determination during Unconstrained Extensor Thrust.** RESNA Conference, Atlanta, GA.

https://www.resna.org/sites/default/files/legacy/conference/proceedings/2005/Research/SM/Hong.html

50. Hong SW, Seomoon H, Patrangenaru V, Singhose W and Sprigle S, (2005). **An efficient identification method for human-generated forces during extensor thrust.** Biomedical Engineering Conference, Innsbruck, Austria.

51. Kangas, K. (2005). **Sensory Systems and Seating for Function: The Need for Both Active Postural Control (Use of the Vestibular System) and Passive Postural Management (Use of the Tactile System).** International Seating Symposium, Orlando, FL. Proceedings, pgs. 47-48.

http://www.iss.pitt.edu/ISS_Pre/ISS_Pre_Doc/ISS_2005.pdf

52. Siekman A. (2005**). Stable, not static: dynamic seating to improve movement and function.** Proceedings of the International Conference on Posture and Wheeled Mobility, Exeter, England.

53. Siekman AR, Hurley SL, Yamada DA, Hayes AM, Noon JH, Axelson PW (2003). **Functional benefits of a dynamic pelvic stabilization system.** International Seating Symposium, Orlando, FL.

54. Kangas, K. (2004). **Sensory Processing & Sensory Integration in Children's Seating and Mobility Systems.** International Seating Symposium, Vancouver, BC. Proceedings, pg. 99.

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