
E2: The influence of disruption in wheelchair and seating practice innovation: Past, present and future

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Learning objectives:

1. To define disruptive innovation and contextualize within the field of wheelchair and seating practice.
2. To identify 5 historical innovations in the area of wheelchair and seating practice and the influence these have had on participation of people who use wheelchairs.
3. To identify areas where disruption will change practice related to the practice of wheelchair procurement and seating in the future, and how we can ready ourselves to engage with this.

Session description:

Whilst wheelchairs have been around for century's, the last 100 years have seen dramatic improvements that have enabled people to participate fully in their daily lives. The first "invalid's chair" was created around 1595 to assist Philip II of Spain overcome mobility issues associated with gout; prior to this, wheelchairs were purposed simply to move people from one place to another. Further developments include the first folding chair in the 1930s and the first successful motorized chair after WWII. Innovations such as these were revolutionary for those with mobility impairments and in contemporary terms, considered "disruptive".

In recent years we have seen incremental improvements in how we provide service to our clients. Examples included pressure mapping to assess for and prevent not only pressure ulcers but also improvement in positioning; tilt in space, which enables improved comfort, mid wheel drive chairs that enable people greater community access and credentialing of therapists to ensure best practice approaches. So where are we going to with wheelchairs and seating? In 2012 Rory Cooper suggested that the science related to wheelchair and seating intervention was escalating and that the next

translational advances would come in the area of power wheelchair interventions.

Disruptive innovation, first defined in the 1990s, describes technologies and practices that replace those that lead to a major change or shift in how we conduct business. What are the advances that have been made in the past 20 years? Are we making sufficient progress to meet the needs of our clients? Are there no more changes to manual wheelchairs that will enable us to advance practice? Could changes to service provision be disrupted to improve practice? Are we focused on high tech approaches when we should be looking at the simple and frugal disruptions? What about ubiquitous smart technologies, and concepts such as precision medicine and big data. Do these concepts apply to mobility and seating also?

In this workshop we will identify the areas of wheelchair and seating practice that have occurred in the past 20-30 years, suggest areas for future development and engage the audience in discussion about where development, science and practice should be focusing efforts in the next 20 years.

Content references:

1. Kaplan, S. (2012). Leapfrogging: Harness the power of surprise for business breakthroughs. Berrett-Koehler Publishers, Inc.
2. Christensen, C.M. (1997), The innovator's dilemma: when new technologies cause great firms to fail, Boston, Massachusetts, USA: Harvard Business School Press,
3. Bryne E. (2012). Q&A: When was the first wheelchair introduced? BBC History Magazine. Retrieved from <http://www.historyextra.com/qa/when-was-first-wheelchair-introduced-did-you-know> (March 29, 201)
4. Cooper, R. (2012). Wheelchair research progress, perspectives, and transformation. *Journal of Rehabilitation Research & Development* 49(1), 1 – 5.

E3: Rationale and evidence for the development of a shear force measurement device

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Learning objectives:

1. Definition and differentiation between different types of shear and friction, introduction of the term Total Shear, clinically referred to as sliding.
2. Identify the negative clinical aspects of sliding and how to prevent these from happening.
3. Clinical application of the iShear: how can it help to improve the wheelchair set-up?

Session description:

There is a lot of confusion around the definition of the terms shear and friction: they are used in conjunction with more extended terms like: Normal force, Shear force, Shear stress, Column Shear, Micro shear, Static and Dynamic friction. Different forms of shear and friction will be further discussed.

There have been numerous attempts in the past to develop devices that can measure shear at the interface between seat and body until now without success.

Sliding as a result of total shear:

The tendency of a wheelchair user to slide is one of the most common problems that we try to overcome in our daily practice of setting up wheelchairs.

The iShear is a newly developed device that is intended to measure the total shear (=sliding force) in the seat resulting from the force that occurs as a result from leaning against the back.

The device is placed in the interface between cushion and seat base underneath the cushion. The force measured by the device is defined as the Total-Shear-Force (TSF).

The iShear can be used in combination with a pressure-mapping device that is placed on top of the cushion. Possibilities for data collection, logging and identifying rotational forces using the iShear will be discussed.

The iShear is the first clinical tool that tells us something about the quality of the set-up of the wheelchair.

Possible applications for clinical use could be:

- Assessing the risk for a wheelchair user to slide.
- Assess the time needed for a wheelchair user to slide, the effect of sliding on the TSF.
- Real time impact measurement of the wheelchair set-up on TSF: determine the influence of back support angle, pelvic position, seat-angle, leg position, cushion adjustment.
- TSF over time: effect of propulsion.
- Documentation of wheelchair set-up.
- Education of junior colleges and users.

Content references:

1. Stockton, L., Gebhardt, K. S., & Clark, M. (2009). Seating and pressure ulcers: Clinical practice guideline. *Journal of Tissue Viability*, 18(4), 98-108. doi:10.1016/j.jtv.2009.09.001
2. Lahmann, N. A., & Kottner, J. (2011). Relation between pressure, friction and pressure ulcer categories: A secondary data analysis of hospital patients using CHAID methods. *International Journal of Nursing Studies*, 48(12), 1487-1494. doi:10.1016/j.ijnurstu.2011.07.004
3. Hanson, D., Langemo, D. K., Anderson, J., Thompson, P., & Hunter, S. (2010). Friction and Shear Considerations in Pressure Ulcer Development. *Advances in Skin & Wound Care*, 23(1), 21-24. doi:10.1097/01.asw.0000363489.38996.13
4. Gilsdorf, P., Patterson, R., Fisher, S., & Appel, N. (1990). Sitting forces and wheelchair mechanics. *The Journal of Rehabilitation Research and Development JRRD*, 27(3), 239. doi:10.1682/jrrd.1990.07.0239
5. Kamegaya T, (2016). Influence of sacral sitting in a wheelchair on the distribution of contact pressure on the buttocks and back and shear force on the ischial region. *J Phys Ther Sci*. 2016 Oct;28(10):2830-2833. Epub 2016 Oct 28.