

Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

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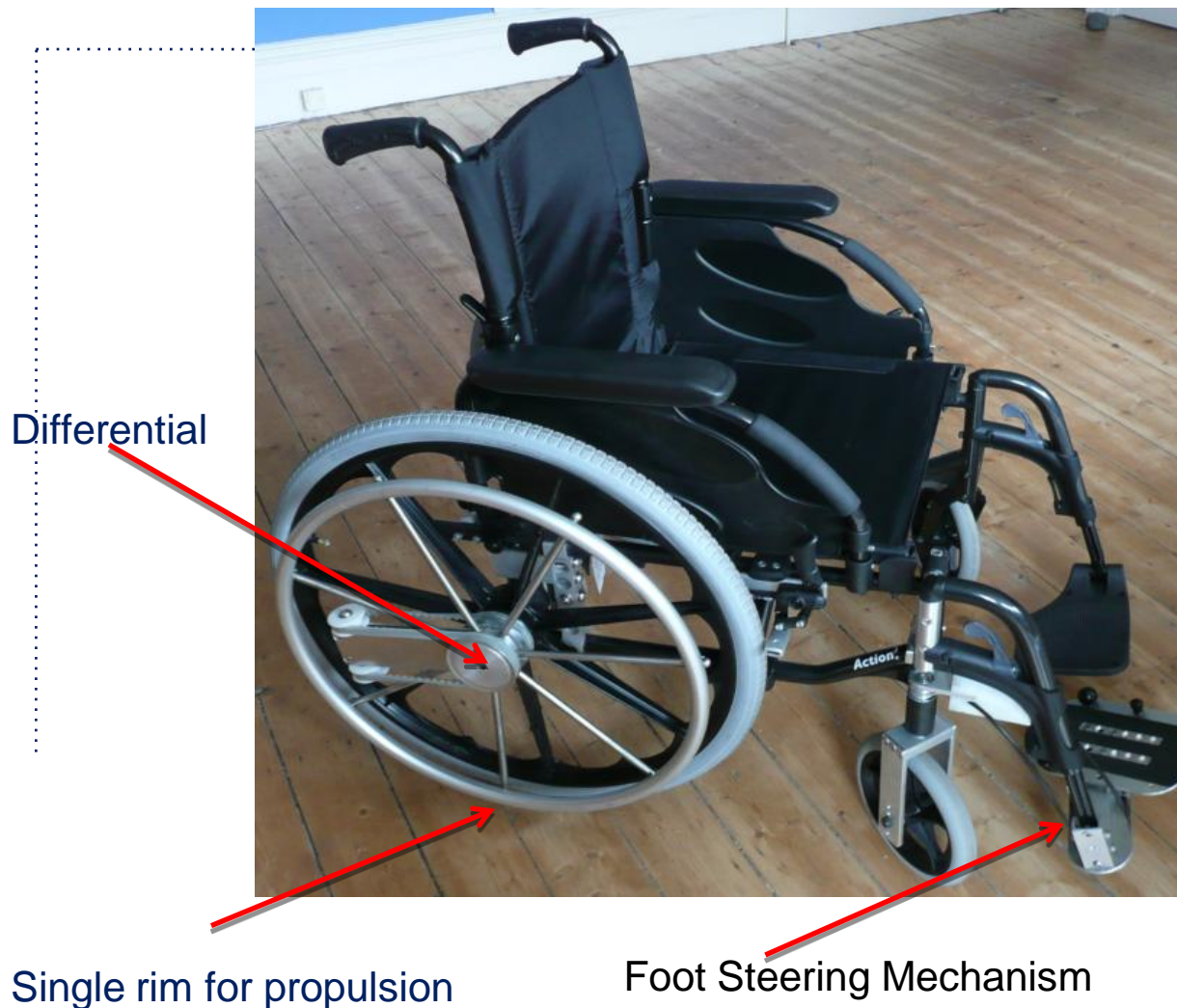
***** Neater Solutions**



University of Brighton

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Neater Uni- Wheelchair



Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

- Previous research has established:
- The Neater Uni-wheelchair to be more an ergonomically efficient to propel compared to either a dual handrim or Lever drive wheelchair
- *Mandy A, Lesley S (2009) Disability and Rehab Assistive Technology 4(3): 137–142*
- *Mandy A, Lesley S (2007) Disability and Rehab Assistive Technology vol. 2, no. 5.255-260*



Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

- Preferred by users

*Mandy A, (2011) International Journal of Therapy and Rehabilitation
18,4,588-593*

- Endorsed by NIHR

- *NIHR Academic-NHS-Industry Collaboration in Experimental Medicine*
www.nihr.ac.uk/nocri

- Shown to enable activities of daily living

- *Bashton D, Mandy A, Haines D, Cameron J (2011) Disability and Rehab Assistive Technology Apr 17.*



Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

- AIMS
- The aim of this study was to compare force distribution during dynamic propulsion in hemiplegic stroke wheelchair users using:
 - the Neater Uni-wheelchair, a dual handrim and a lever drive one arm drive wheelchair.
 - Force was measured using *CONFORMat*[®] Pressure Measurement System



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- Ethical approval was granted by North Wales Research Ethics Committee
- The Posture & Mobility client database was used to identify clients who were currently using either a dual handrim or lever drive one arm drive wheelchair.

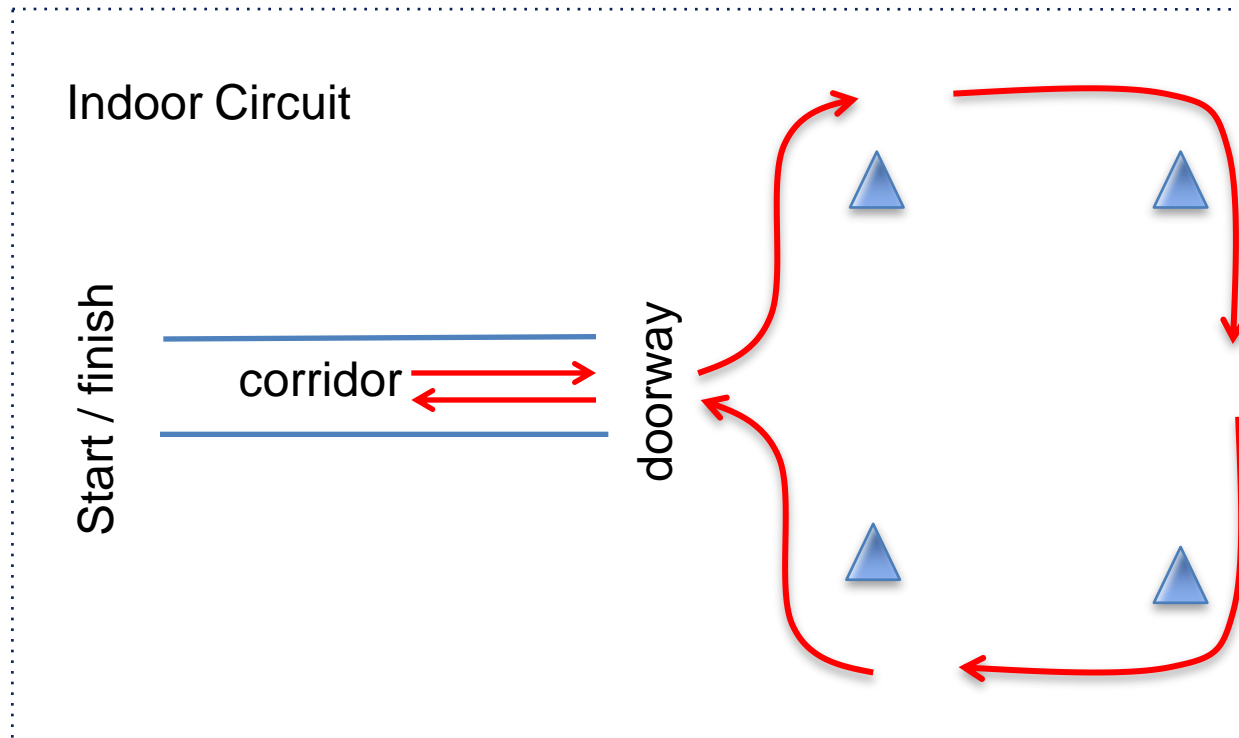


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- 20 stroke patients met the inclusion criteria and were invited by letter to participate the study.
- The study involved familiarisation with each of the wheelchairs prior to driving around an indoor obstacle course.
- When competent, they were asked to navigate an indoor course which included driving around obstacles.
- During the entire course, the force between the buttocks and the seated sling surface of the wheelchair was measured using a *CONFORMat*[®].



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- 15 left hemiplegic users agreed to participate
(6 Female & 9 Male).
- Mean age 56.6yr SD 17.1
- Range 24-83



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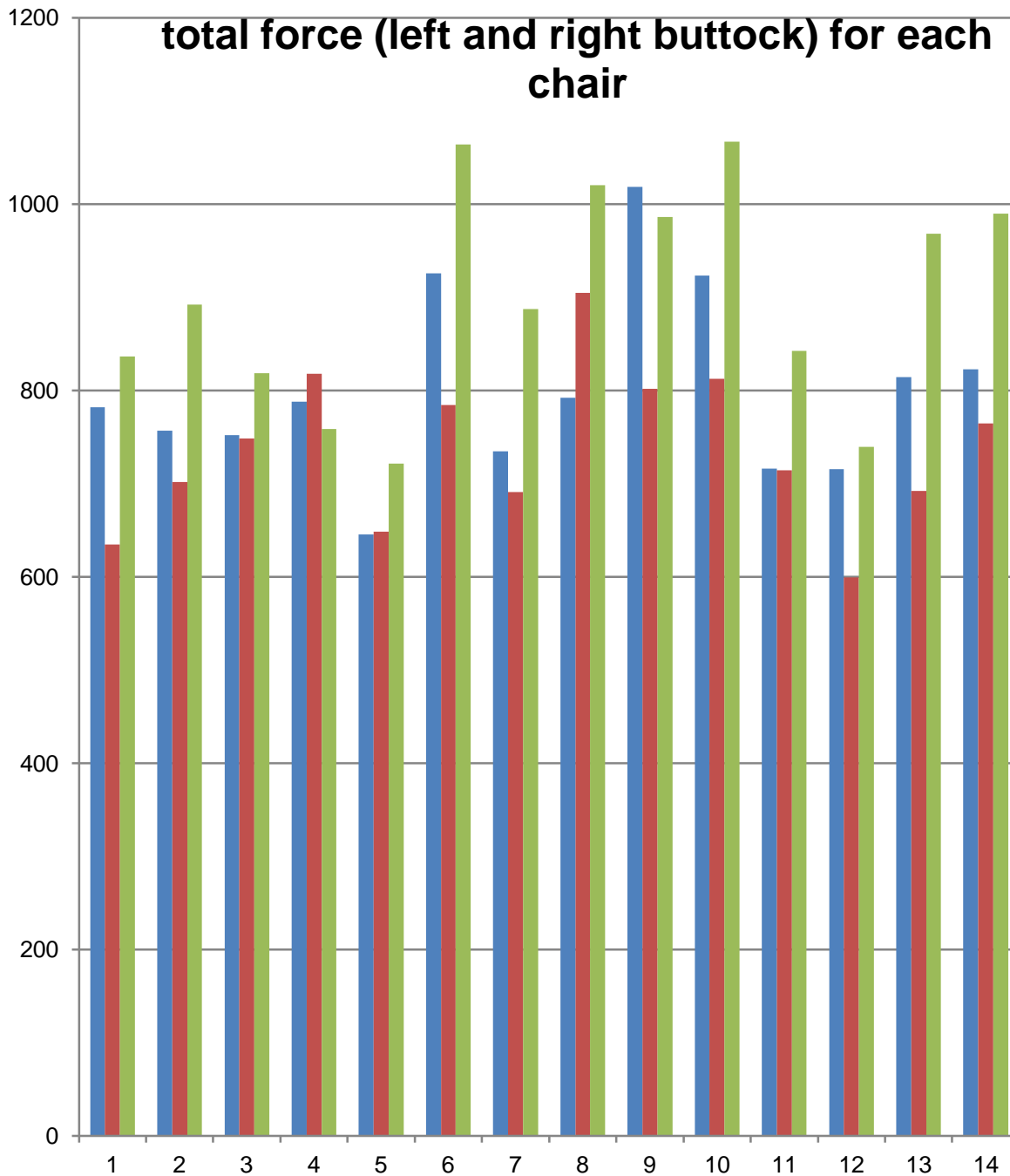
- Analysis included:
- Time taken to complete the course
- Force Data Patterns
 - Force was measured under the IT's on both the hemiplegic and non-hemiplegic side in each wheelchair.
 - Mean force and Confidence intervals were calculated per user to compare force under each buttock in each wheelchair.



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- Mean Time taken to complete the circuit
- Neater Uni-wheelchair 81 secs
- Lever 86 secs
- Dual handrim 130 secs
- The Neater and Lever were significantly faster than the Dual handrim ($p < 0.01$)





Using the Dual Handrim Wheelchair generates the most force

Using the Lever Wheelchair generates the least force



Table to Show Distribution of Force in the Non-hemiplegic side

Right side Least Force			
User	Neater v Lever	Neater v Dual	Lever v Dual
1	L	N	L
2	L	N	L
3	N	N	L
4	Aberrant data	Aberrant data	Aberrant data
5	ns	D	D
6	ns	N	L
7	L	N	L
8	L	N	L
9	N	N	D
10	L	N	L
11	L	N	L
12	L	N	L
13	L	N	L
14	L	N	L
15	L	N	L
Totals	L=10	L=0	L=12
	N=2	N=13	N=0
	D=0	D=1	D=2
	NS=2		

Lever produces less force than Neater

Neater produces less force than the dual handrim

Dual handrim produces the most force



Table to Show Distribution of Force in the hemiplegic side

Left side Least Force			
User	Neater v Lever	Neater v Dual	Lever v Dual
1	N	ns	D
2	L	N	L
3	L	N	L
4	Missing data	Missing data	Missing data
5	N	N	D
6	ns	D	D
7	N	N	L
8	N	N	L
9	N	N	L
10	L	D	L
11	N	N	L
12	N	N	ns
13	N	D	D
14	N	N	L
15	N	N	L
Totals	L=3	L=0	L=9
	N=10	N=10	N=0
	D=0	D=1	D=4
	NS=1	NS=1	NS=1

**Neater wheelchair
produces less force
than the lever or dual
wheelchairs**



Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

- Comparing total force distribution across the buttocks between the wheelchairs:
- The Neater Uni-wheelchair and Lever produce less force than the Dual handrim ($p < 0.0001$)
- The Dual handrim produces the highest force ($p < 0.0001$)



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- Presently the dual handrim represents the largest proportion of one arm drive wheelchairs.
- This data suggests that the dual handrim is the most inefficient and requires the greatest force for propulsion.
- The lever wheelchair required the least force for propulsion however, there is a literature which suggests that the lever wheelchair results in upper limb over use injuries. (Veeger et al 1992)
- The Neater was shown to be an efficient alternative to the Lever wheelchair.



Force Distribution using Dynamic Mapping in 3 different one arm drive wheelchairs

- Position versus posture
- Traditional practice challenged with evidence based practice
- Further work is now required to explore upper limb biomechanics during propulsion of these wheelchairs.

