handicare

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VISAFE FINAL REPORT

MAY 2018

REVOLUTIONARY WEARABLE SENSOR TECHNOLOGY

Project aim

Compare the musculoskeletal effects to the back and shoulder when operating the EvaDrive versus the Eva 450.

Assessment methodology

- ½ day on-site assessing the Eva 450 and the EvaDrive, handling 0kg versus 100kg.
- Sensor readings synchronised with video footage.

Postural risk factors measured during ViSafe Assessment:

- Back
  - Lumbar flexion/ extension
  - Lumbar lateral flexion
  - Electro-muscular activity of Erector Spinae muscles
- Shoulder
  - Upper arm elevations
  - Electro-muscular activity of upper Trapezius muscles

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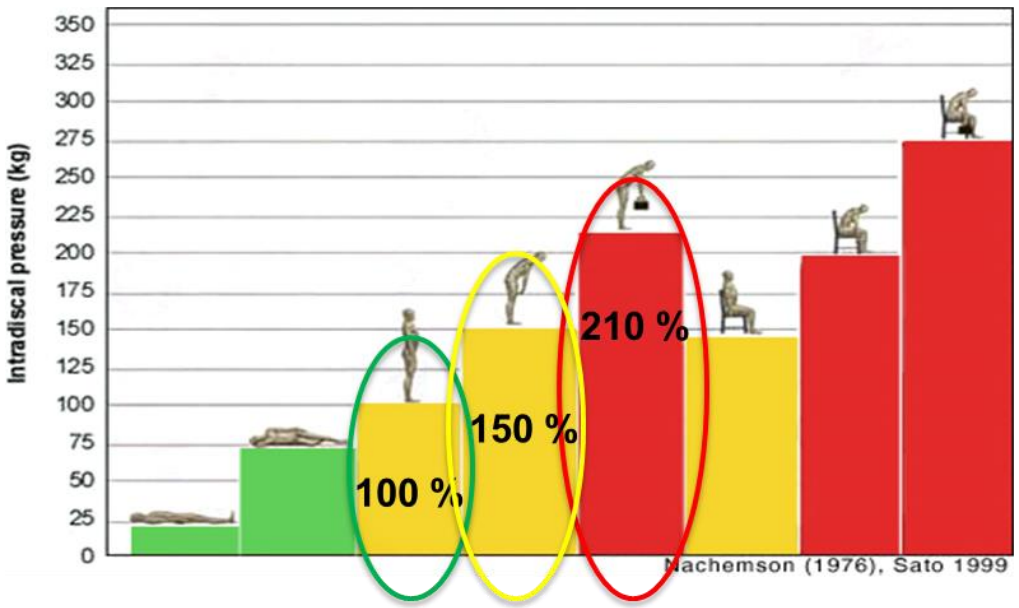
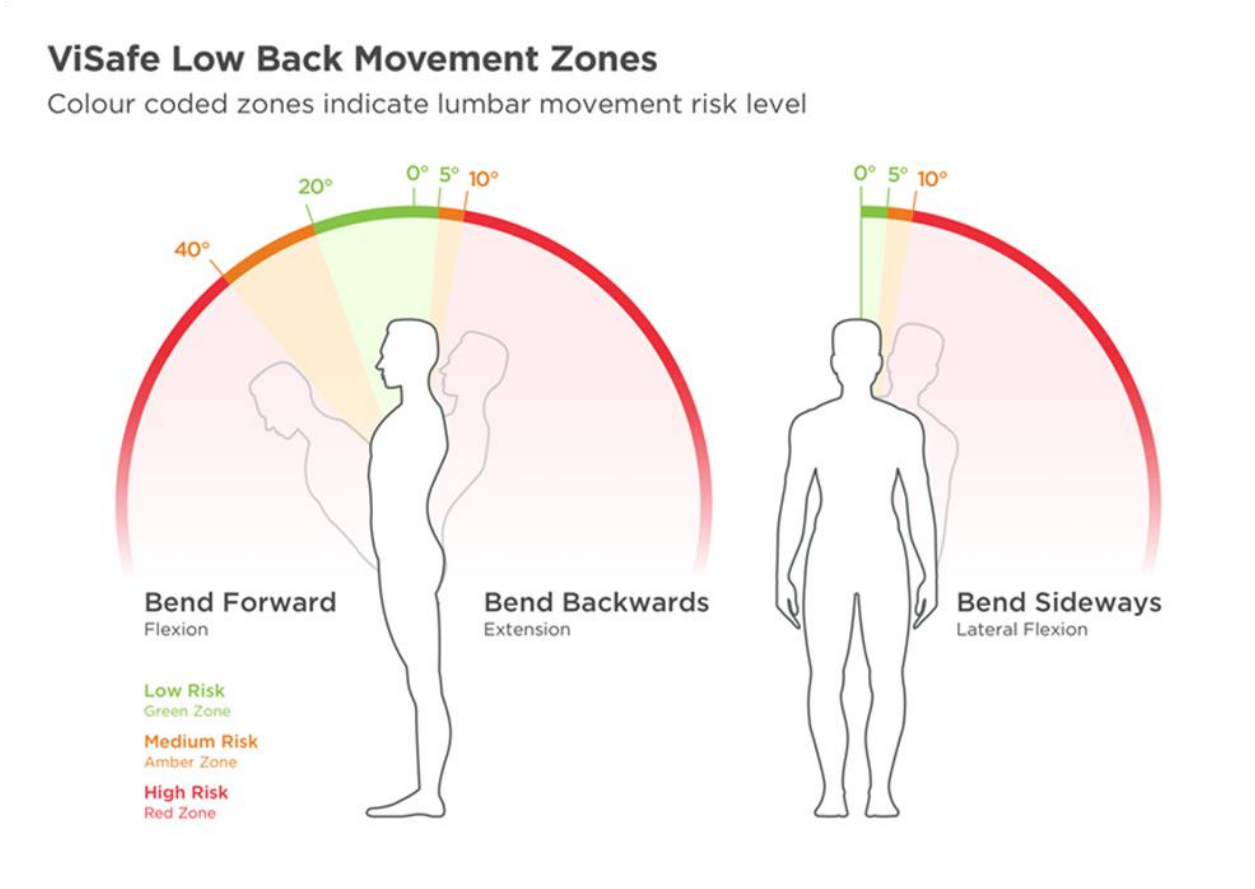
Postural Code of Practice and ViSafe Scoring Rules

Injury risks: Effects of poor posture on the spine

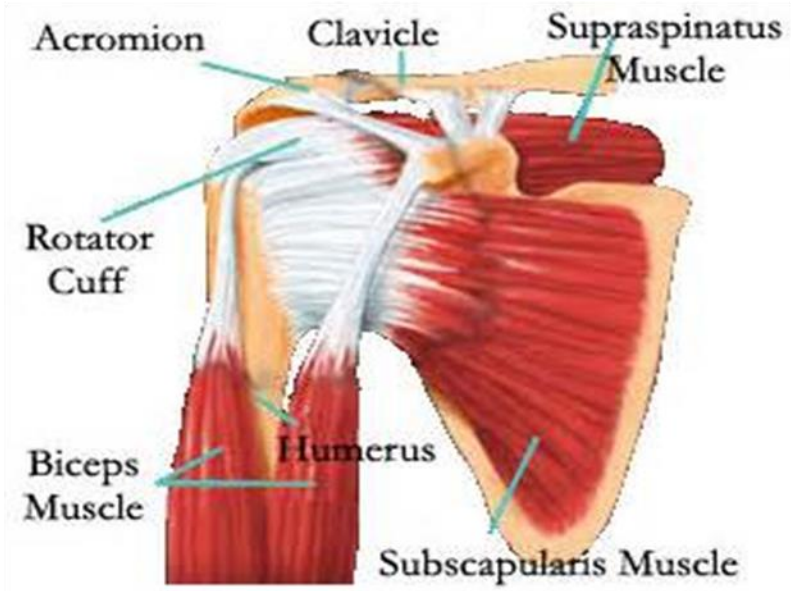
Disc pressure in various postures relative to unloaded, upright standing

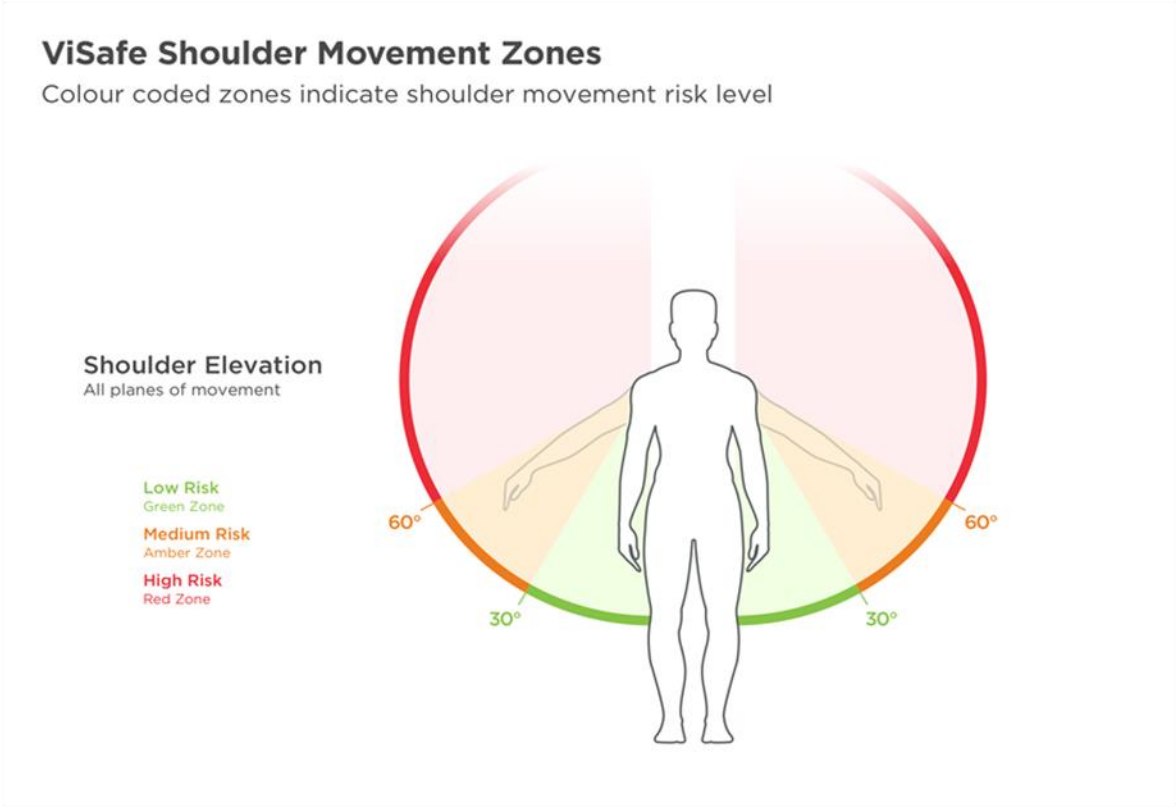




Ergonomists, literature and clinicians agree on the effects of cumulative poor posture on the lumbar and cervical spine and the potential for disc and musculoskeletal injuries to occur.

Injury risks: Effects of sustained shoulder elevation





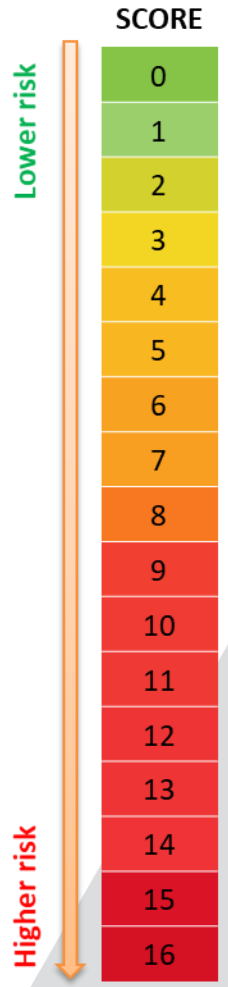
Sustained elevation and internal rotation of the upper arm can lead to decreased blood flow to the critical tendons around the rotator cuff. Ergonomists, literature and clinicians agree on the undesirable effects of sustained elevation on shoulder tendons.

Results Summary

Movement & Muscle Score: 0kg

Eva 450: 0kg	Back Score	Shoulder Score	Total Score
180 degree rotation (on the spot to the right)	0	1	1
1m move side-to-side	0	1	1
5m straight line Push and Pull	0	1	1
90 degree rotation (on the spot to the left)	0	0	0

EvaDrive: 0kg	Back Score	Shoulder Score	Total Score
180 degree rotation(on the spot to the right)	0	0	0
1m move side-to-side	0	0	0
5m staight line Push and Pull	0	0	0
90 degree rotation (on the spot to the left)	0	0	0



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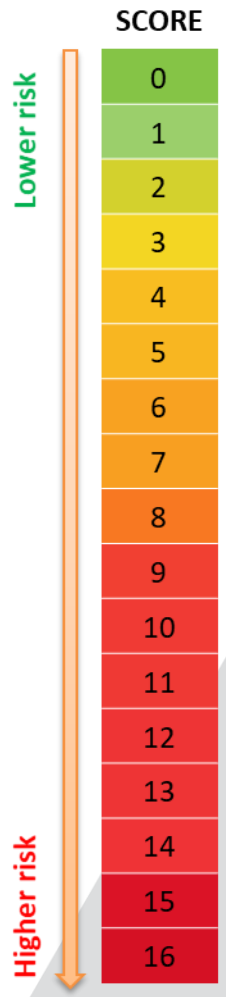
Movement & Muscle score: 100kg weight

Eva 450:100kg	Back Score	Shoulder Score	Total Score
180 degree rotation (on the spot to the right)	1	3	4
1m move side-to-side	2	3	5
5m straight line Push and Pull	0	2	2
90 degree rotation (on the spot to the left)	0	3	3

EvaDrive: 100kg	Back Score	Shoulder Score	Total Score
180 degree rotation (on the spot to the right)	0	0	0
1m move side-to-side	0	1	1
5m straight line Push and Pull	0	0	0
90 degree rotation (on the spot to the left)	0	0	0



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100Kg: *180° rotation on the spot to the right*

100kg	Eva 450			
	Back	Back Lateral	Left Shoulder	Right Shoulder
ROM % time	Preferred	Preferred	Preferred	Attention 31%
Repetitions per minute	Preferred	Attention 4 reps	Preferred	Attention 4 reps
Sustained positions	Preferred	Preferred	Preferred	Preferred
EMG	Preferred	Preferred	Alert	Attention
Score	1		3	
Task Score	4			

100kg	EvaDrive			
	Back	Back Lateral	Left Shoulder	Right Shoulder
ROM % time	Preferred	Preferred	Preferred	Preferred
Repetitions per minute	Preferred	Preferred	Preferred	Preferred
Sustained positions	Preferred	Preferred	Preferred	Preferred
EMG	Preferred	Preferred	Preferred	Preferred
Score	0		0	
Task Score	0			

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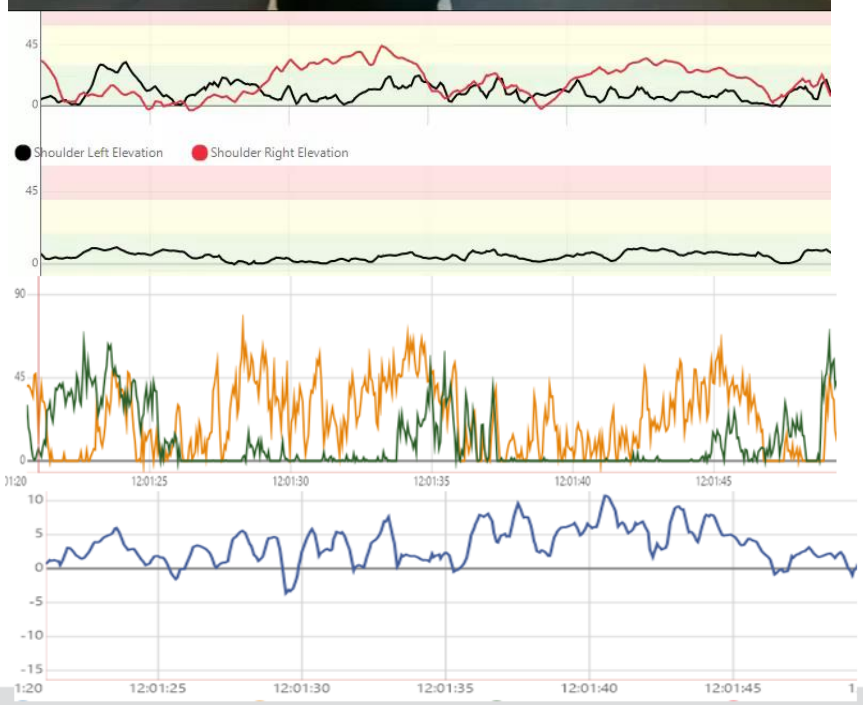
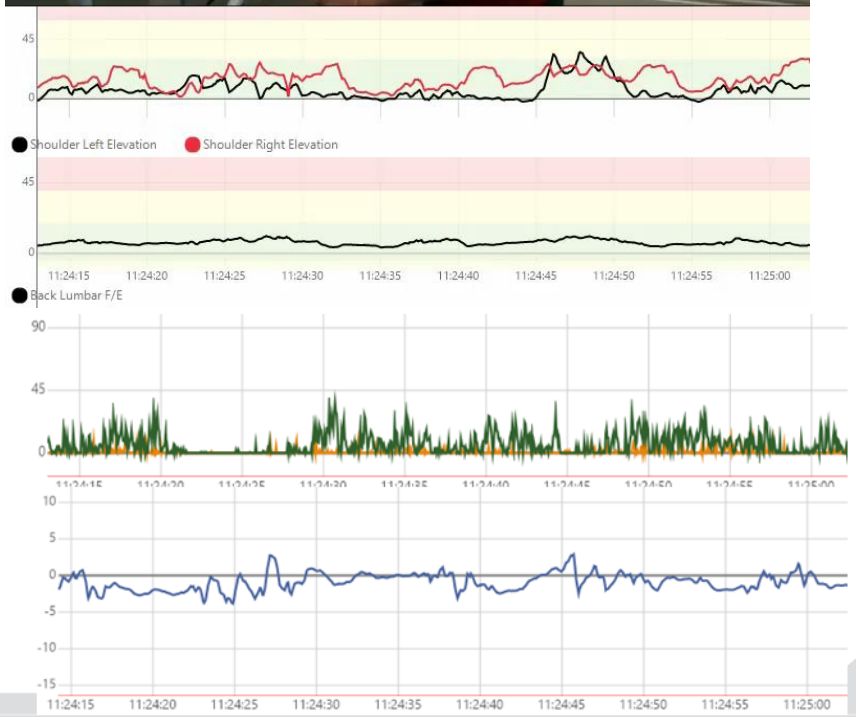
100Kg: *180° rotation on the spot to the right*





Shoulder EMG

Back Lateral flexion

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100Kg: *1m move side-to-side*

100kg	Eva 450			
	Back	Back Lateral	Left Shoulder	Right Shoulder
ROM % time	Preferred	Preferred	Preferred	Preferred
Repetitions per minute	Preferred	Alert 2 reps	Preferred	Attention 2 reps
Sustained positions	Preferred	Preferred	Preferred	Preferred
EMG	Preferred	Preferred	Alert	Alert
Score	2		3	
Task Score	5			

100kg	EvaDrive			
	Back	Back Lateral	Left Shoulder	Right Shoulder
ROM % time	Preferred	Preferred	Preferred	Preferred
Repetitions per minute	Preferred	Preferred	Preferred	Attention 2 reps
Sustained positions	Preferred	Preferred	Preferred	Preferred
EMG	Preferred	Preferred	Preferred	Preferred
Score	0		1	
Task Score	1			

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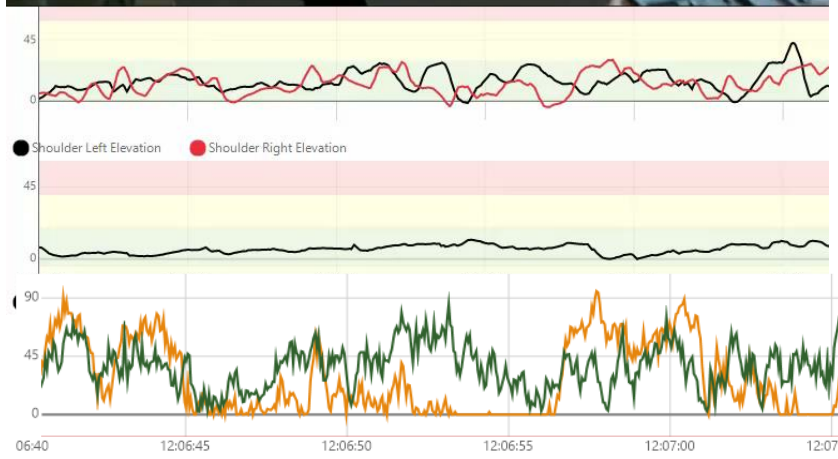
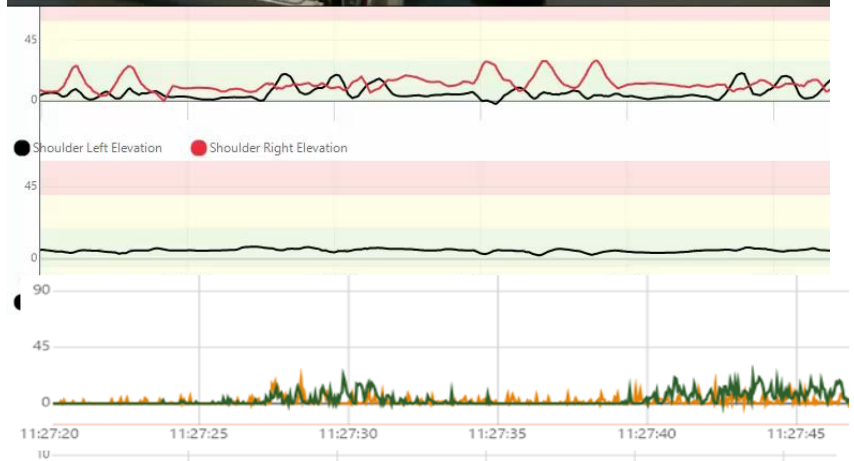
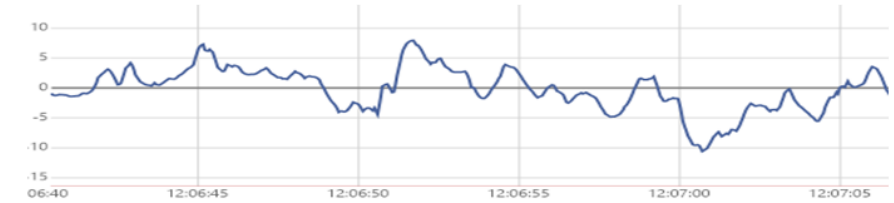
100Kg: *1m move side-to-side*





Shoulder EMG

Back Lateral flexion



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Summary of Findings

Assessment Findings

The results of this preliminary movement and muscle study suggest that the **EvaDrive** has significant advantages over the **Eva 450** when considering risk reduction for musculoskeletal disorders associated with manual handling injury. The EvaDrive consistently demonstrated reduced movement and muscular effort, particularly when handling weight, and also promotes safe, single-handed care in-line with NHS long-term strategic goals.

Handling 0kg:

- Negligible difference in movement risk between Eva 450 and EvaDrive
- Up to **61% ↓ shoulder muscle effort** with EvaDrive versus Eva 450
- Up to **86% ↓ back muscle effort** with EvaDrive versus Eva 450

Handling 100kg:

- All movement and muscle effort for the EvaDrive remained in the **low risk zone**. Conversely, movement and muscle effort for the Eva 450 was mostly in the **moderate risk zone**. This risk was predominantly associated with the **shoulder joint**
- Up to **100% ↓ in back lateral flexion** with EvaDrive versus Eva 450
- Up to **93% ↓ in shoulder muscle effort** with EvaDrive versus Eva 450
- Up to **99% ↓ in back muscle effort** with EvaDrive versus Eva 450
- When operating the Eva 450, the increase in muscle effort when moving from 0kg- 100kg is high for both back and shoulders (**94% and 86%** respectively). Conversely, when operating the EvaDrive, the increase in effort when moving from 0kg – 100kg is low for both back and shoulder (**18% and 2%** respectively). This would suggest that the effort required to handle the EvaDrive is consistently low, regardless of the weight being moved.

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Clinical Observations

The literature suggests that the following patterns are associated with **Shoulder Impingement Syndrome** (SIS):

- Force requiring >10% of maximal voluntary contraction(MVC)
- heavy lifting of >20kg >10 times/ day
- repetitive movements of the shoulder,
- working with upper-arm flexion ≥45° ≥15% of time

(Van Rijn, Huisstede, Koes, & Burdorf., 2010)

Furthermore, with repetitive and sustained postures during a task/shift, the rotator cuff becomes fatigued leading to altered shoulder mechanics and impingement (fatigued rotator cuffs leading to humeral head moving superiorly in glenoid fossa) in both symptomatic and asymptotic individuals (NIOSH, 1997).

dorsaVi findings support that handling the Eva 450 requires force above 10% MVC, in addition to lifting load above 20kg and repetitive shoulder movement. This is in contrast to the EvaDrive which requires none of the above, therefore reducing the level of risk.

Clinical Observations

A NIOSH publication on the epidemiologic evidence for WRMSDs concluded that there is strong evidence that low-back disorders are associated with work-related lifting and forceful movements (Bernard, & Putz-Anderson, 1997).

Handling the EvaDrive significantly reduced the user's EMG activity for both low back and shoulder. The higher EMG activity required when operating the Eva 450 implies that there is a higher amount of force (effort) required to manoeuvre, especially with heavier patients. Higher EMG activity is known to increase the risk of repetitive strain injuries or acute injuries. High forces can cause MSDs even if they are not repetitive or sustained. However more commonly, the damage results when muscles generate moderate to high levels of force repeatedly, for a long duration, and/ or while the body is in an awkward posture. The longer and more often force is applied and the higher the force, the greater the risk of Work Related Musculoskeletal Disorder (WRMSD).

dorsaVi findings show repeated requirement for force in combination with lateral/rotational movement when operating the Eva 450. In contrast to the EvaDrive where both force and movement requirements are consistently low.

Next steps

- Consider ViSafe objective comparison in a ‘real’ environment such as Bury St Edmunds NHS Trust; to capture environmental factors such as time restrictions, work space, change in flooring, patient or public behavior etc. All of which may contribute to posture and force requirements on the carer.
    - **Data captured in this format would promote use in existing accounts and drive training requirements, in addition to creating a strong business case for use in prospective accounts.**
- Consider replicating study design across Handicare product portfolio to build a catalogue of risk profiles for key equipment. Highlighting those with strongest advantage against competitors for reducing manual handling risk**.**
    - **Data captured in this format would priorities products with *reduced risk* as a point of difference.**
- Consider ViSafe comparative study to eliminate/reduce risk at design phase for future product developments.
    - **Data captured in this format would position Handicare at the forefront of risk prevention for future product generations, in addition to driving a unique portfolio of evidence based care .**

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