

# Effect of Mobi-Lift® on patients mobilisation

## PROJECT OBJECTIVE:

Evaluation of physical load on patients when rising from a bed using Mobi-Lift® function <sup>(1)</sup>



## MEASUREMENT PERFORMED BY:

NATIONAL INSTITUTE OF PUBLIC HEALTH, CZECH REPUBLIC  
National Reference Unit for Occupational Physiology and Psychophysiology

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## Method and measurement conditions, apparatus used and evaluation methodology

### A) Integrated electromyography

Integrated electromyography was used to examine local muscular load. The integrated electromyogram shows total muscular activity and is a function of the amplitude, duration and frequency of the individual EMG potentials. A portable 8-channel polygraph was used for measurements and an EMG Holter with 4 EMG modules was used to record physiological parameters. EMG modules measure and record the electrical potentials that accompany muscular activity and serve to monitor muscle function. EMG potentials are recorded by special surface electrodes.

#### ELECTRODES PLACEMENT – UPPER LIMBS:

Flexor palmaris longus of right arm; Extensor digitorum of right arm; Flexor palmaris longus of left arm; Extensor digitorum of left arm.

#### TRUNK:

Erector spinae left side; Erector spinae right side.

#### LOWER LIMBS:

Rectus femoris of right limb; Rectus femoris of left limb.

### B) Motion Capture

Motion Capture technology was used to record posture, using a Noitom motion capture suit; the applied method used 17 sensors with a sampling rate of 30 Hz.

## TESTED SUBJECTS:

- All activities were repeated by three subjects – adult healthy volunteers without any movement limitations.

## MEASURED OBJECTS:

Medical device – Multicare & Multicare X – intensive care and therapy beds intended as a solution for the demanding special needs of critically ill patients.

To support patients while standing up the bed is equipped with a unique Mobi-Lift® solution. The Mobi-Lift® handle is designed to actively support patients' mobilisation. The handle serves as a stable point and can set the bed to an ideal height for standing to reduce physical strain on the patient.

# Evaluation of physical load on patients when rising from a bed using Mobi-Lift® function.

1. Without use of Mobi-Lift® the hospital bed was situated at a height of 60 cm (measured at top of mattress) and patients were asked to rise in a normal manner with slight initial support of the hands against the mattress).

Picture 1, 2

(Without use of the Mobi-Lift®)



2. During use of Mobi-Lift® the patients were at the starting height of 60 cm and were gradually elevated using the Mobi-Lift® handle to the maximum or other height where it was possible to naturally achieve a vertical position. During this action the patients held the operating handle in their right hand and the handle on the upper part of the bed in their left.

Picture 3, 4

(With use of the Mobi-Lift®)



## IEMG – INTERPRETATION UPPER LIMBS

Rising from the bed results in mild engagement of upper limb muscle groups. When rising from the bed at a height of 60 cm the mean maximum muscular force of hand and forearm flexor muscle groups ranged between 36% and 43% of the maximum muscle force of hands and forearms inferred from MVC (Maximum voluntary contraction). The mean maximum muscular force of hand and forearm extensor muscle groups ranged between 7% and 10% MVC.

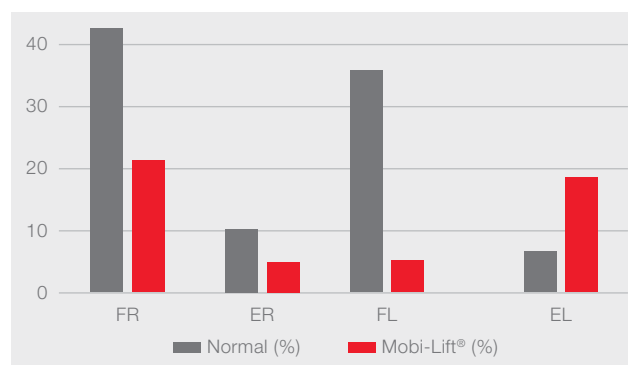
When rising from the bed with use of Mobi-Lift® the mean maximum muscular force of hand and forearm flexor muscle groups ranged between 6% to 21% MVC, and between 5% and 19% MVC for extensor muscles.

### Table and graph 5

(Mean values of maximum muscular force exerted when rising from bed – trunk – upper limbs)

Average values (P1...P3)					
Task type	Values	Right flexor muscle groups (FR)	Right extensor muscle groups (ER)	Left flexor muscle groups (FL)	Left extensor muscle groups (EL)
Normal	Force (%)	43	10,2	36	7
Mobi-Lift®	Force (%)	21.8	5	5.8	19.2

*Note: The value of average maximum muscular force (% MVC) is relative to the maximum force voluntary contraction (MVC) of the hands and forearm. Differences in recorded muscular force between the different modes of rising from bed are not great: the target population of patients with decreased mobility does not have upper limb condition as its primary limiting factor, and the results shown are of an informative character.*



## IEMG – INTERPRETATION TRUNK

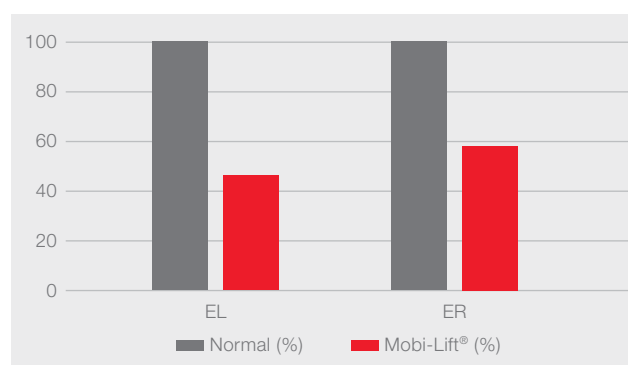
Maximum muscular force exerted during rising from the bed with use of Mobi-Lift® ranged from 46% to 59% of force exerted when performing the same task without Mobi-Lift® function.

### Table and graph 6

(Mean values of maximum muscular force exerted when rising from bed – trunk)

Average values (P1...P3)			
Task type	Values	Left extensor muscle groups (EL)	Right extensor muscle groups (ER)
Normal	Force (%)	100	100
Mobi-Lift®	Force (%)	46,1	59.1

*Note: There were marked differences caused varying heights of the subjects. Even at the highest bed elevation the tallest patient had to compensate by slightly pushing off from the bed. This dynamic stabilising movement resulted in relatively high recorded force values which approached those found during rising from a bed at a height of 60 cm.*



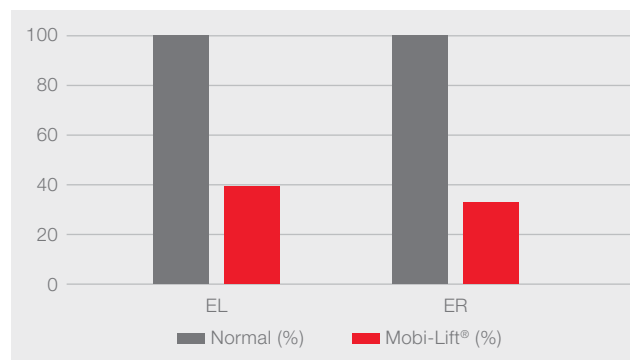
## IEMG – INTERPRETATION LOWER LIMBS

Maximum muscular force exerted during rising from bed with use of Mobi-Lift® in lower limbs ranged from 33% to 39% in comparison to force measured without Mobi-Lift® function.

### Table and graph 7

(Mean values of maximum muscular force exerted during rising from a bed – lower limbs)

Average values (P1...P3)			
Task type	Values	Left extensor muscle groups (EL)	Right extensor muscle groups (ER)
Normal	Force (%)	100	100
Mobi-Lift®	Force (%)	39.8	33.9



## INTERPRETATION POSTURE

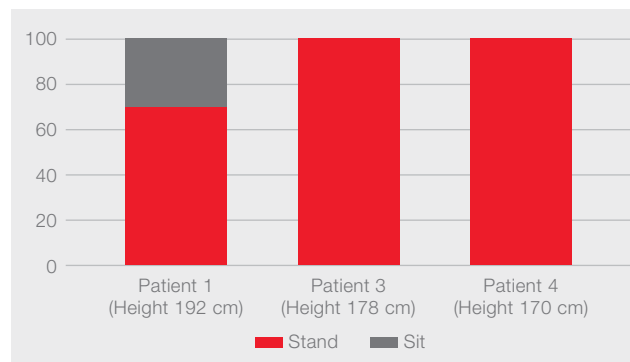
Results are shown of patients rising from a bed with and without use of Mobi-Lift®. The comparison is targeted at evaluating the extent to which it was necessary for patients to rise in order to achieve a completely upright position whilst using Mobi-Lift® function. The baseline height of the top of the mattress during standing up without Mobi-Lift® was 60 cm, and this height designated as 100% sitting position. A 100% standing position was designated for each patient that stood upright with a mean 5° flexion of the knee joint.

The results show the endmost position to which patients rose to finish their mobilisation. A 192 cm tall patient using Mobi-Lift® achieved 70% standing position at 20° knee flexion. The other patients achieved 100% standing position with Mobi-Lift® function.

### Table and graph 8

(Percentages of the extent to which patients of varying heights must additionally rise whilst using Mobi-Lift®)

Mobi-Lift®		Patient 1	Patient 3	Patient 4
		Height 192 cm	Height 178 cm	Height 170 cm
	Stand	70%	100%	100%
	Sit	30%	0%	0%



## Concluding interpretation of results

Use of the Mobi-Lift® function decreased patient load when rising from a bed. Use of **Mobi-Lift® function led to decreased lower limb load by an average 63%** and decreased **trunk load by an average 47%** against standing up in the normal manner. The results confirm a use of Mobi-Lift® function facilitate stand up for patients.

Results clearly confirmed 100% standing position after elevation of patients up to 178 cm height, whereas a standing position of 70% was achieved in the case of a 192 cm high subject.

## REFERENCES:

1. Lebeda T et al., NRU for Occupational Physiology and Psychophysiology, Report no: 3636/2021, ex. 210347



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