HF-kaart van Vlaanderen

FYSIEK

Using inflatable cushions is significantly less straining than manually proning patients

For many healthcare professionals, transferring patients poses a substantial risk of developing musculoskeletal disorders. Reducing manual handling during these patient transfers by properly using adequate tools can lower the number of injuries and the duration of unavailability for work. A challenging case for patient positioning is seen in spine surgery in the procedure known as proning: after sedation, the patient is rolled over and then positioned onto supporting thoracic-pelvic supports (the prone position). This way of patient positioning is usually carried out manually, where the patient is either tilted or lifted.

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We compared three proning methods: inflatables (one for the proning and another one for the prone positioning (IF) (figure 1), manual lifting (ML) (figure 2), or manual tilting (MT) (figure 3) of the patient onto the thoracic-pelvic supports. Six subjects performed the three different proning methods (in randomized order) three times, with a standardized rest period in between and the same male patient weighing 80kg. s-EMG was measured bilateral of the m. erector spinae (ERS, large back muscle) and the m. trapezius pars descendens (TRD, neck- and shoulder muscle). The raw s-EMG signal was processed (band-pass filtered 15-273 Hz, RMS sliding window 508 ms) and normalized with a sub-maximal voluntary contraction (the peak strain in MT). The results of 2 subjects were excluded because of the signal loss (sensor failure) or the poor signal quality (bad skin contact due to excessive sweating). The median (P50) and the peak strain (P95) of the normalized ERS and TRD signal were analyzed through linear mixed-effect modeling.

Figure 1. Snapshots of the IF method: horizontal transfer to the side of the bed by sliding, followed by inflating the inflatable board for turning the patient over and finished by inflating the prepositioned thoraco-pelvic supports.

Figure 2. Snapshots of the ML method: horizontal transfer to the operating table by sliding, followed by manually turning the patient over and finished by manual lifting the patient.

Figure 3. Snapshots of the MT method: horizontal transfer to the side of the bed by sliding, followed by manually rolling the patient over on the thoraco-pelvic supports and finished by manual repositioning on the thoraco-pelvic supports.

Compared to manual lifting, using inflatables results in a reduction in the shoulder muscle of 12% (left) and 28% (right) for the median strain and 39% (left) and 34% (right) for the peak strain. Back muscle activation of 15% (left) and 18% (right) for the median strain and 19% (left) and 35% (right) for the peak strain. These differences are highly significant for left (TRD.L) and right (TRD.R) shoulder muscles ($p<0.001$). This is also the case for the left (ERS.L) ($p<0.05$) and right (ERS.R) back muscles ($p<0.001$) (figure 4).

Compared to manual tilting, using inflatables results in a reduction in shoulder muscle activation of 14% (left) and 39% (right) for the median strain and 23% (left) and 38% (right) for the peak strain. A reduction in back muscle activation of 22% (left) and 19% (right) for the median strain and 14% (left) and 17% (right) for the peak strain. These differences are significant for the left (TRD.L) ($p<0.001$) and right (TRD.R) shoulder muscles (P50: $p<0.001$; P95: $p<0.05$). In the back muscle, significance was found only for the median muscle strain ($p<0.001$) (figure 5).

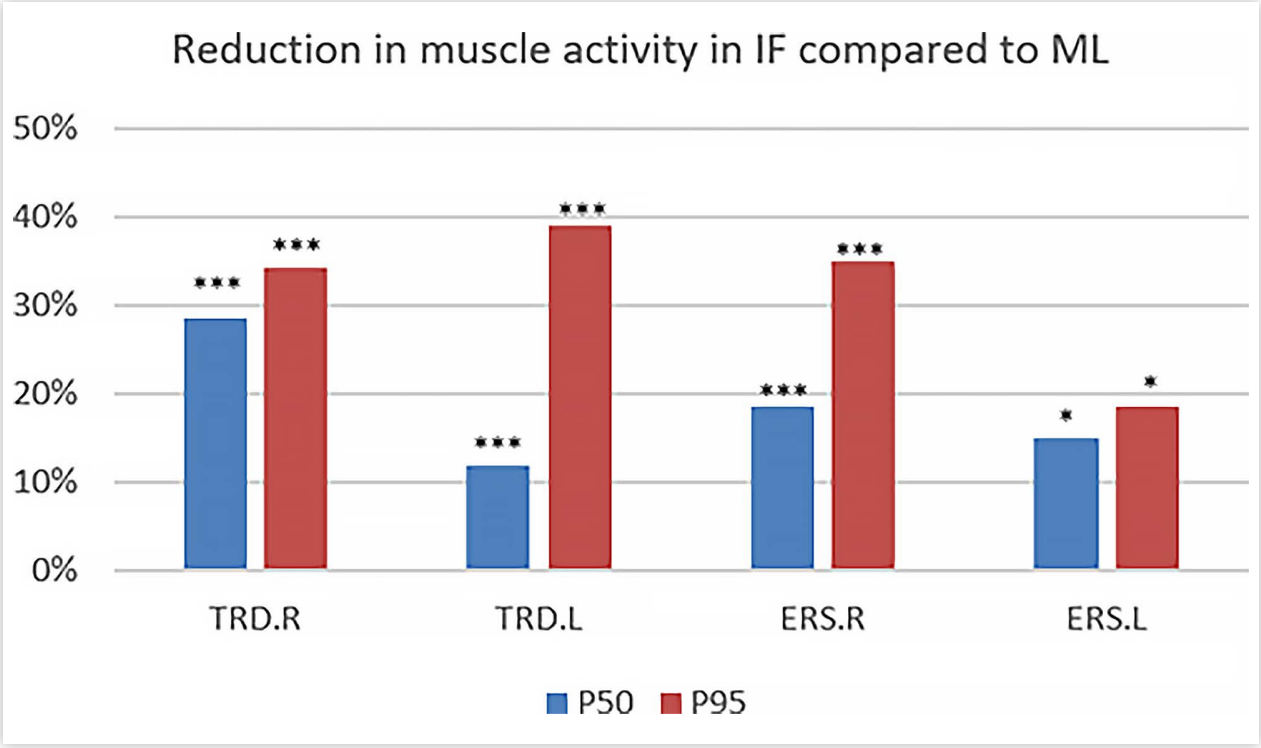

Figure 4. Reduction in muscle strain in IF compared to ML for the median (P50) and peak strain (P95) of the different muscles.
* ($p<0.05$) and *** ($p<0.001$) show the significance levels of the reduction.

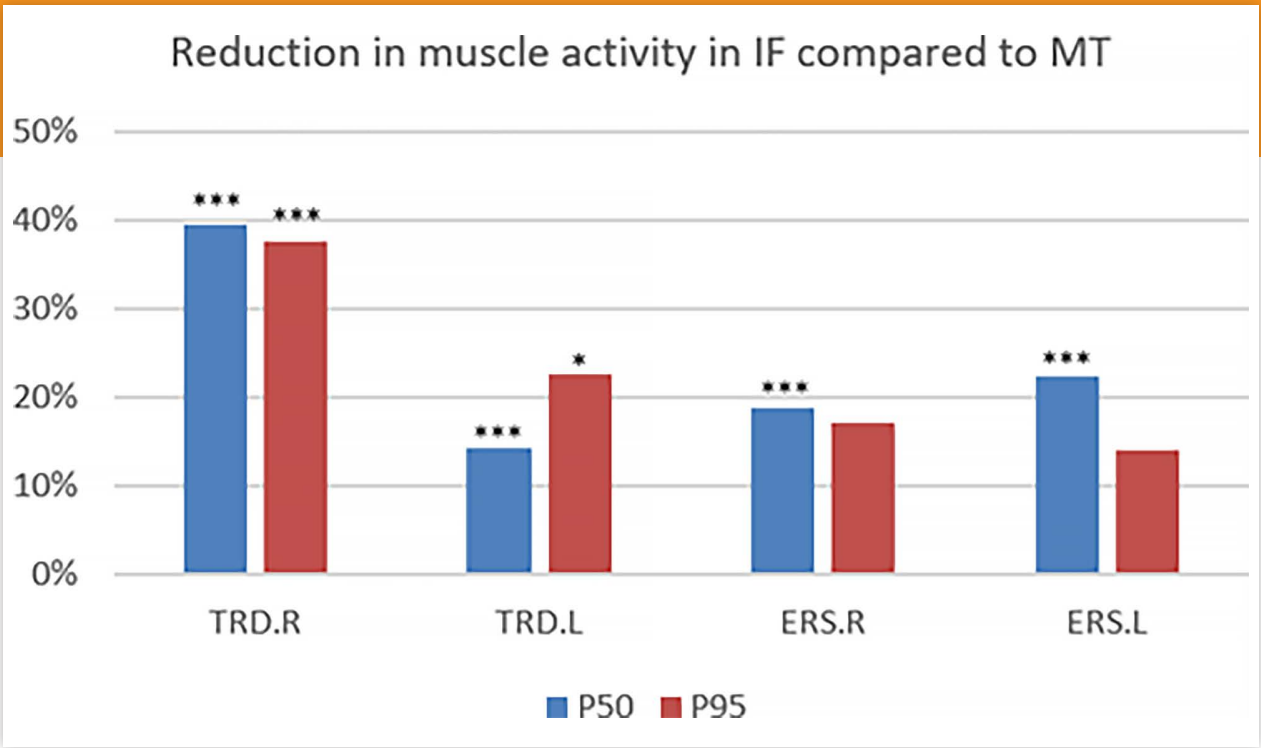

Figure 5. Reduction in muscle strain in IF compared to MT for the median (P50) and peak strain (P95) of the different muscles.
* ($p<0.05$) and *** ($p<0.001$) show the significance levels of the reduction.

Studies have shown that the ergonomic condition of the operation room is one of the factors substantially associated with work-related MSD and that reducing manual handling by proper use of adequate tools can contribute to tackling the impact of MSD. Based on our results, using inflatable cushions is preferable above the manual execution of proning. Since the comparison of both manual proning methods is less clear, there can be no preference for either method: ergonomic solutions should be searched in developing and using proper tools to avoid manual force exertion and manual handling. Other researchers suggested already to consider to embed patient tilting assistance in patient turning devices for reducing caregivers injury risk in the low back and upper extremities.

However, since proning reflects only a portion of the tasks (and the strain), further research needs to be conducted to form an overall picture of the physical strain and take additional targeted measures to improve the physical workability. Besides ergonomic conditions, among others, breaks between procedures, overtime, nightshift, absence of assistance and duration of the procedure are factors associated with work-related MSD. Besides providing proper tools to avoid manual handling and to diminish manual force exertion, also organizational measures are necessary to tackle MSD.

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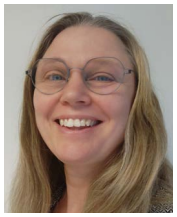

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