International Journal of Health Sciences and Research
Vol.12; Issue: 10; October 2022
Website: www.ijhsr.org
Case Study *ISSN: 2249-9571*

Effect of Stool Movement on A Physiotherapist MSD Risk During Manual Lymphatic Drainage: A Case Report

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DOI : https://doi.org/10.52403/ijhsr.20221013

ABSTRACT

[Background] Physiotherapists have a high prevalence of musculoskeletal disorders (MSDs). The study of stool movements performed by the physiotherapist during manual lymphatic drainage has never been treated. It is known that the use of a stool allows improving the posture.
[Purpose] The aim of the present work was to analyse the stool movements and its contribution in the prevention of work-related MSDs during the practice of manual lymphatic drainage through the analysis of postures over a period of 6 months. It can be hypothesized that the stool use should reduce MSD risk.
[Participant(s) and Methods] Ten 20-minutes manual lymphatic drainage performed by a 39-years physiotherapist were recorded by two numerical cameras. Each stool movement (displacement/repositioning) and its duration were quantified. The posture adopted by the physiotherapist before and after each movement stool was defined by neck, trunk, and upper and lower limbs joint angles. The MSD risk associated with each posture was quantified using the Rapid Upper Limb Assessment (RULA).
[Results] Eighty-six stool displacement/repositioning were identified. Joint ranges were characterized by a mean (± standard deviation) for the 10 massages performed. The difference in RULA score between the pre- and post- stool movement postures was computed to highlight the potential risk of MSDs. Results illustrated that 19% (16) of the stool movements (56% repositioning and 44% displacement) led to an increase in the RULA score. The posture adopted as a result of stool movements presented a greater risk of MSDs. Some recommendations have been proposed.
[Conclusion] Manual lymphatic drainage activities over a long period of time expose physiotherapists to significant MSD risks even when using a rolling stool. Quick changes are needed to prevent their occurrence. During displacement or repositioning, it appears necessary to modify habits and behaviours to reduce the RULA score and therefore the MSD risk. This approach can be extended over a longer period of time including more subjects in order to quantify individual risks and propose recommendations.

Keywords: Musculoskeletal disorders, Physiotherapy, Posture, Ergonomics, RULA, Massage, Manual lymphatic drainage.

INTRODUCTION

Musculoskeletal disorders (MSDs) are a major issue for physiotherapists. Many studies have reported significant MSD prevalence ranging from 61.0% [1] to 91.7% [2]. The areas most affected are the neck (47.6%-63.0%) [3, 4], the lower back (37.2%-66.0%) [5, 6], and the shoulder (29.0%-45.2%) [7, 8]. Awkward and static postures, repetitive tasks, unsupported sitting position, long working days … are

parameters that cause MSDs to occur [1, 5, 9].

Manual therapies such as classical massages or manual lymphatic drainages constitute a significant part of the physiotherapists' activity. Specificity of these treatments is that they are often performed in a sitting position. In the particular case of manual lymphatic drainage (MLD), the rolling stool is indispensable. Indeed, MLD consists in applying regular and repeated pressure on the whole limb to reduce the size of an edema [10]. It has been shown in the literature that the stool supported the neutral position of the lower back to reduce muscle loads through 90° hip flexion [11, 12]. Furthermore, it allows practitioners to move from one massage area to another or reposition themselves to massage the same area.

In this context, it becomes important to quantify and qualify stool movements in order to assess the postural benefits and to reduce the MSD risk for physiotherapists. Ergonomic tools such as the Rapid Upper Limb Assessment (RULA) [13], the postural loading on the upper body assessment (LUBA) [14] or the Rapid entire body assessment (REBA) [15] allow to qualify a posture using a score from biomechanical parameters (joint angles, manipulated load ...). The RULA presents the advantage of focusing on the neck, trunk and upper limbs, which are the areas most exposed to massage practice [16]. The RULA score provides information on the level of MSD risk on the basis of four levels: 1-2 corresponds to acceptable posture and no changes are required, 3-4 is for low risk and changes may be required, 5-6 is for moderate risk and changes are required soon, and 6+ corresponds to high risk changes are required immediately.

The aim of this case study was to investigate the effect of stool movements on the work-related MSD risk associated with the practice of manual lymphatic drainage through the analysis of postures over a period of 6 months. The hypothesis would be that if the stool is well used, the MSD risk should decrease.

MATERIALS & METHODS

The study focused on Manual Lymphatic Drainage (MLD) performed by a right handed female physiotherapist (39 years; 156 cm; 70 kg). It allowed the study of stool movement and its implication in the prevention of MSDs over a long work period of 6 months.

She works full time 7 hours a day for 5 consecutive days followed by two days off. She has 19 years of experience, including 7 years in her current neurology department at the Léon Bérard Hospital. She did not suffer from any musculoskeletal disorders. MLD represents an average 1/7 of her working time.

MLD is usually used to reduce the volume of edema resulting from the accumulation of lymphatic fluid in an upper or lower extremity that has developed as a complication of pathology (cancer) [10]. It consists in the application of repeated pressure less than or equal to 60 mmHg without sliding on each segment of the affected limb for a period of 20 minutes. The physiotherapists perform the massage sitting on a backless rolling stool. It allows repositioning themselves in relation to the limb to be massaged while the patient is lying on the table.

Two digital cameras were placed to film the physiotherapist frontal and sagittal planes directly within her department. Ten manual lymphatic drainages were recorded. Each recording was sampled with a 5-second interval. Two experts quantified the physiotherapist's posture on each sample image, i.e. a total of 2371 postures (approximately 230 postures per massage) [17]. Furthermore, each stool use and its corresponding duration were quantified. A "displacement" corresponds to the stool movement between two areas to be massaged, e.g. when the physiotherapist moves from the foot to the leg or from the leg to the thigh. A "repositioning"

corresponds to a stool movement while remaining in the same massage area.

The posture adopted by the physiotherapist before and after each displacement or repositioning was defined by the following joint angles: neck, trunk, shoulders, elbows, hip and knee flexion or extension; neck and trunk inclination; shoulders and hips abduction or adduction. The Rapid Upper Limb Assessment (RULA) was used to assess the risk of MSD occurrence for each posture.

The physiotherapist was informed of the experimental procedure and gave her written informed consent before the beginning of the study. The protocol has been approved by the local ethics committee was in agreement with the Helsinki declaration [18].

RESULT

In a previous study, 2371 postures during the ten MLD were evaluated [17]. Among them, the 165 postures corresponding to the 86 pre- and post- identified movement stool were extracted. Massage 4 was not included in the analysis because no stool displacement/repositioning was performed by the physiotherapist. Figure 1 illustrates the range of ten joint angles for all MLD.

The lowest ranges were observed for neck and trunk inclination (20° and 35° respectively). Neck and trunk flexion were close to 40° (41° and 38° respectively). The shoulder and elbow showed large range of motion close to 90°. Large variations in postures were also observed for the lower limb (change of postures) with amplitudes close to 140° for hip and knee flexion. Table 1 summarizes the mean values and standard deviations achieved for each joint angle during the 10 massages. The neck, trunk and shoulder had significant flexion for all massages. Seven of the 10 massages presented neck flexion greater than 20°. Eight of the 10 massages presented trunk flexion higher than 10° (3 of them higher than 15°). Eight of the 10 massages displayed shoulder flexions higher than 30° (4 of them greater than 40°). Elbow flexions were close to 90° for 2 massages whereas the values were lower for the others. For the lower limb, the hip and knee flexion were close to 90° with slight variations between massages. Hip abduction presented the highest postural variability (from -10 to 25°).

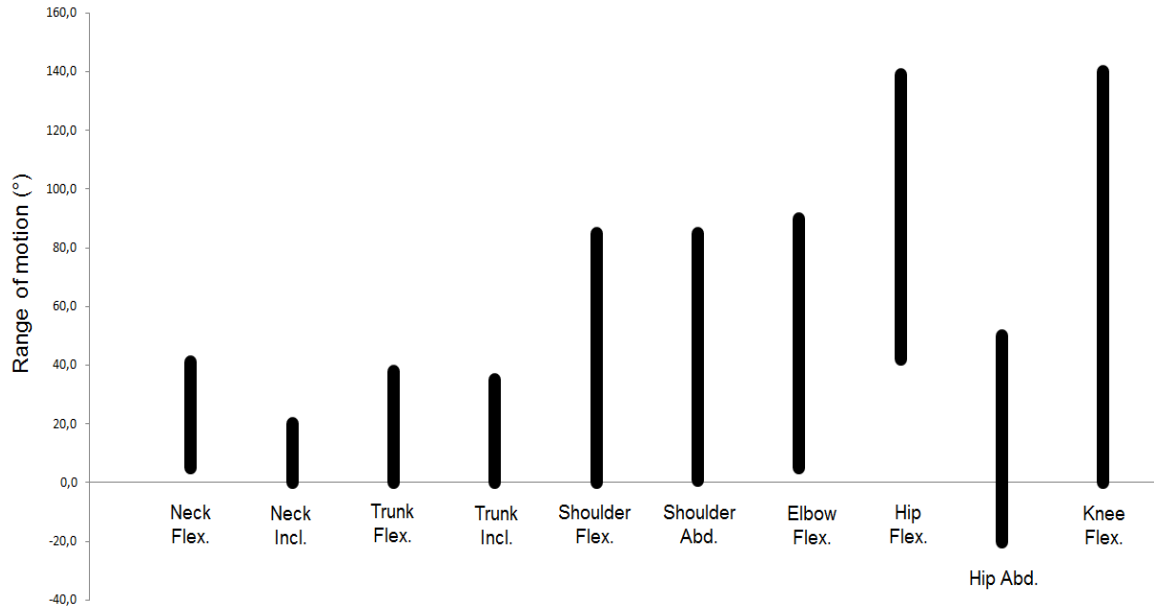


Figure 1: Joint angle range of motion including all postures pre- and post- displacement/repositioning. Flex. = flexion; Incl. = inclination; Abd. = Abduction. Negative abductions correspond to an adduction.

Table 1: Mean (±SD) of each measured joint angle before and after all displacement/repositioning for each MLD

	M1	M2	M3	M4*	M5	M6	M7	M8	M9	M10
Neck Flexion (°)	19.3±5.5	16.0±0.0	23.0±9.2	-	30.0±0.0	40.0±0.0	31.1±5.1	20.2±9.8	29.4±3.6	24.3±7.8
Neck Inclination (°)	1.9±1.6	0.0±0.0	2.5±0.6	-	2.1±0.3	2.0±0.0	2.0±0.0	2.8±3.2	1.4±0.5	1.3±0.5
Trunk Flexion (°)	12.2±5.8	14.3±8.3	9.5±5.2	-	16.1±3.4	21.5±9.2	13.8±8.4	14.5±12.7	18.4±9.2	14.2±6.3
Trunk Inclination (°)	6.7±4.3	0.0±0.0	6.0±4.6	-	10.5±1.6	10.0±0.0	1.8±0.4	7.6±9.9	15.8±12.4	8.3±9.7
Shoulder Flexion (°)	42.8±15.7	54.0±13.3	35.0±5.8	-	29.0±32.1	18.0±0.0	37.9±23.8	51.7±26.9	36.3±17.5	44.0±15.5
Shoulder Abduction (°)	11.8±11.6	35.8±19.7	67.0±5.8	-	15.1±21.7	39.0±0.0	18.2±8.0	11.8±7.4	19.9±14.9	24.3±16.9
Elbow Flexion (°)	51.4±22.2	74.9±10.9	81.5±6.4	-	61.8±32.8	51.0±0.0	57.5±29.6	41.8±29.6	55.0±21.4	49.5±27.3
Hip Flexion (°)	110.0±21.2	75.3±13.4	80.0±0.0	-	85.5±1.6	85.0±0.0	86.7±8.5	76.8±4.9	90.0±0.0	90.0±0.0
Hip Abduction (°)	17.8±30.2	25.0±0.0	0.0±0.0	-	-8.9±3.1	-10.0±0.0	-6.1±4.9	3.7±5.7	3.8±11.4	12.5±13.3
Knee Flexion (°)	109.2±22.4	100.0±0.0	80.0±0.0	-	90.0±0.0	90.0±0.0	81.3±21.0	72.4±6.5	96.3±5.2	90.0±0.0

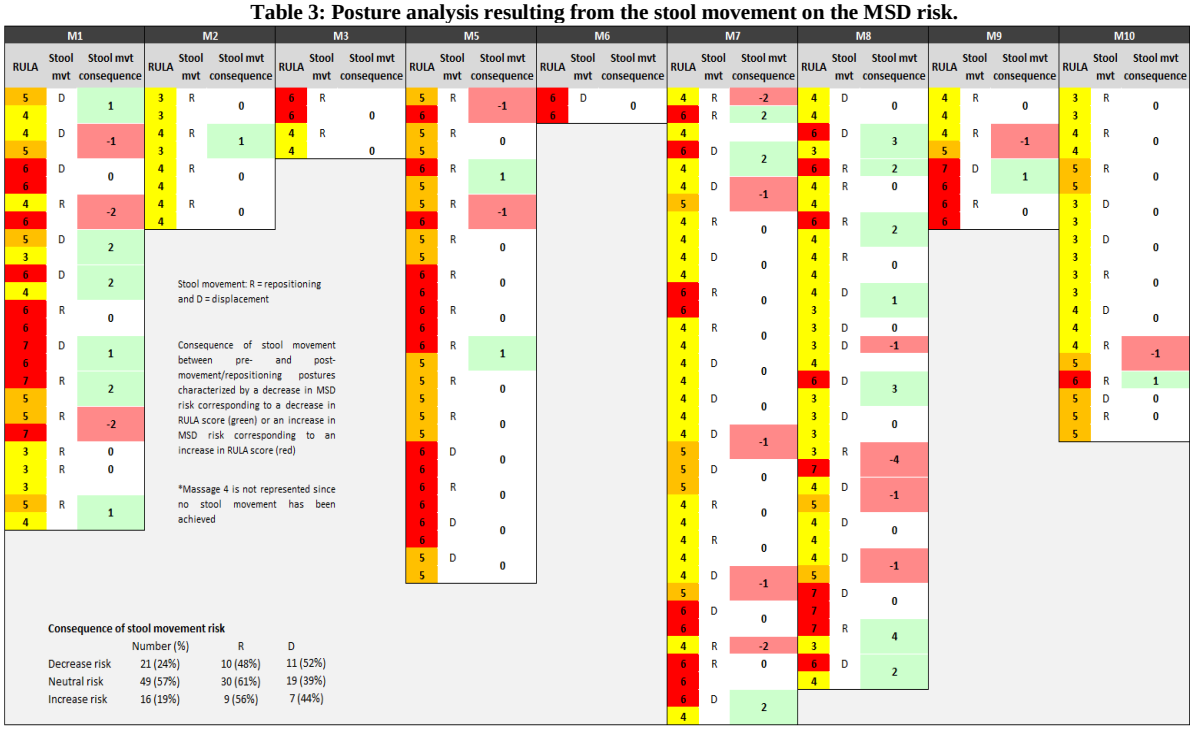
M=massage; * M4 has no value because no stool movement has been performed.

Table 2: number and duration of stool movements (displacement/repositioning) by massage

	M1	M2	M3	M4*	M5	M6	M7	M8	M9	M10	TOTAL
Displacement / repositioning duration (s)	32	6	2	-	21	2	29	41	6	17	156
Number of repositioning	7	4	2	-	11	0	9	6	3	7	49
Number of displacement	6	0	0	-	3	1	10	12	1	4	37
Total number of stool movement	13	4	2	-	14	1	19	18	4	11	86

M=massage; * M4 has no value because no stool movement has been performed.

Table 3: Posture analysis resulting from the stool movement on the MSD risk.



M=massage*; R=repositioning; D=displacement; Mvt=movement. In each "Stool mvt consequence" column, the green boxes (positive values) correspond to a movement/repositioning involving an increase of the RULA score and the red boxes correspond to a decrease of the RULA score when using the stool (negative value). White boxes containing 0 indicate no change in RULA score. The value indicates the change in RULA score between the pre- and post-movement postures. M4 was not presented because no stool movement has been performed.

Table 2 summarizes the data on stool movements. Eighty-six stool movements were recorded over the 10 massages. They were divided into 49 repositioning and 37 displacements. The nature and the number of the stool movements (displacement and repositioning) varied significantly from one massage to another. For example, only one displacement was recorded during Massage 6, whereas Massage 7 included 19 movement stools. Massage 5 was mostly composed of repositioning (11/14 movement stool) while more displacements were observed in Massage 8 (12/18 movements). The same observation was made for the duration. The 86 movements represented a total duration of 156s with a great variability between massages: 2s of movement stool were recorded during Massage 6 while Massage 8 cumulated 41s.

Table 3 details data relative to the 165 pre- and post-movement stool postures (RULA score, nature – displacement/repositioning - and consequence) for each massage. The results showed that the RULA scores were equal or greater than 5 (high risk of MSD) for 51.5% of the postures involved in the movement stool. No posture had a score of 1-2 corresponding to no MSD risk. Table 3 also displays the consequences associated with each stool movement by comparing the RULA scores of the postures before and after a move or repositioning. Sixteen (19%) of these movements resulted in an increase in the RULA score and thus in the associated MSD risk. In contrast, 21 (24%) movements improved posture (reduction in RULA score) and therefore reduced MSD risk.

DISCUSSION

The aim of this work was to evaluate the effect of stool movement on the risk of MSDs associated with MLD practice in an easy and rapid manner using ergonomic task analysis (RULA). The postures adopted every 5 seconds by the physiotherapist during 10 MLDs performed over a 6-month period were studied. One hundred and sixty five postures involved in 86 stool uses were identified. The difference between the RULA score of the pre- and post- stool movement was used to determine whether this use induced an increase or decrease in MSD risk.

The analysis of the 165 postures provided the range (mean ± SD) of the neck, trunk, and upper and lower limb joint angles (Figure 1). The results showed that the upper limbs demonstrated significant joint ranges of 90°. These variations were larger than those observed by Gorce et al. (2021) [19] during a texting/web browsing sitting task with a smartphone (shoulder flexion 12.2°; shoulder abduction: 14.4°; and elbow flexion: 20.4°). The neck and trunk displayed more moderate variations with range of 41° and 38° respectively. Quite similar results were observed on seated positions in dentists with cervicothoracic variations of 55 to 65° [20] (De Bruyne 2021) and thoracolumbar range of 24.2 to 74.3° [11, 21] or in smartphone users with trunk flexion of 30° [22]. Our results showed significant flexion values for the neck, trunk and shoulder respectively greater than 20°, 10° and 30° with reduced elbow flexion of around 50° (Tableau 1). In agreement with the RULA table [13], these values are likely to generate MSD in the medium term. These results were consistent with those proposed by Albert et al (2006) [23]. The authors reported that shoulder, trunk and elbow flexions were mild to severe for a significant portion of 44-minute massages, which would expose physiotherapists to a risk of cumulative musculoskeletal disorders. These awkward postures in manual therapy practice reflected the significant prevalence reported in many physiotherapy surveys for these joints [3, 4, 24].

The RULA scores computed for the 165 postures revealed that half (51.5%) were equal or greater than 5, i.e. high MSD risks with the need to make changes quickly [13]. These results are consistent with those proposed by Albert et al. (2006) and Jacquier-Bret et al. (2022) [16, 23]. The stool movement analysis was conducted

according to two purposes: moving to a new area (37/86 or 43%), called displacement, or repositioning to massage the same area (49/86 or 57%). To our knowledge, the study of stool movements on MSD risks has never been studied. On the other hand, some authors focused on ergonomics of the stool seat in order to promote the use of a neutral position for the back to limit exposure to MSDs [21, 25].

Furthermore, of the 10 massages studied, 21 (24%) stool uses reduced the risk of MSDs, 49 (57%) neutral situations maintained the RULA score and 16 (19%) stool movements induced an increase in the RULA score and thus the MSD risk. It is clear from the negative movements (increase in RULA score) and neutral movements (constant RULA score) that the expected benefits of using a rolling stool are not systematically present. This is especially true when the RULA score remains constant and high, which is observed in 43% of cases with a score greater than or equal to 5. Massage with rolling stool must therefore be seriously monitored, especially in the medium and long term, to prevent MSDs. These results were present for both displacements and repositioning. For the latter, we could have expected that the change in posture would lead to a reduction in risks, but 23/49 repositioning (47%) altered (9) or maintained risky postures (14). All these results could lead to the recommendation in order to improve them as follows:

- approaching the neutral position,
- reduce trunk and neck rotation/inclination,
- reduce shoulder flexion.

It is therefore important to pay particular attention to posture and movement/positioning. Repositioning must be used when posture is awkward and to control the postural quality when moving to a new area.

In this study, it is very clear that the use of the benefits of the stool is under-utilized. Indeed, only 86 stool uses for a total duration of 2.5 minutes out of 3h20 of massage were recorded (i.e. 1.5% of the total time).

CONCLUSION

Manual lymphatic drainage is a risky activity that places physiotherapists in awkward postures for long periods of time. The use of a rolling stool is a good way to allow practitioners to adjust their posture but appears to be under-utilized. Further study is needed to maximize the benefits and reduce the risk of MSD exposure.

Acknowledgement: We thank the Léon Bérard hospital director for allowing us to carry out the study. We thank the neurology department of the Léon Bérard hospital in which the data acquisition took place.

Conflict of Interest: None

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How to cite this article: Julien Jacquier-Bret, Philippe Gorce. Effect of stool movement on a physiotherapist MSD risk during manual lymphatic drainage: a case report. *Int J Health Sci Res.* 2022; 12(10):98-104. DOI: *https://doi.org/10.52403/ijhsr.20221013*

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