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Comparing the effectiveness of lumbar contralateral rotation to unilateral posteroanterior mobilization in the treatment of unilateral low back pain: A single-blinded randomized placebo-controlled trial

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ABSTRACT

Background: The use of manipulative therapy to treat patients with non-specific low back pain (NSLBP) has been proposed based on the patient's clinical presentation.

Objective: To investigate the effects of the lumbar contralateral rotation and unilateral posteroanterior (uniPA) mobilizations on LBP intensity and lumbar range of motion (LROM) in the treatment of unilateral NSLBP patients.

Materials and methods: A single-blinded randomized placebo-controlled trial was conducted. Sixty of unilateral NSLBP were randomly allocated using concealed opaque envelopes into 2 groups either; rotation or uniPA groups and collected the pre-intervention data (O1). All participants were received a detuned short-wave diathermy technique and collected the after-placebo data (O2). Then, the therapist treated the participants according to their group allocation and collected the after-mobilization data (O3). Lastly, the participants were recalled within 2 days to collect the follow-up data (O4). Two-way mixed repeated analysis of variance and Paired t-test was used to investigate the immediate and latent effects, and placebo and flare-up effects, respectively.

Results: The result showed no placebo effect ($p>0.05$). There was no difference between groups and time effects (both immediate and latent effects) ($p>0.05$). However, there were statistically significant differences within group of immediate and latent effects on pain reduction and LROM improvement ($p<0.001$). Moreover, results noted on the flare-up on pain alleviation at rest in the uniPA group ($p<0.05$).

Conclusion: These findings partially support the recommendation of using mobilization techniques in the treatment of NSLBP patients with unilateral symptoms.

Introduction

Low back pain (LBP) is a prevalent musculoskeletal condition, affecting over 80% of people globally at some point in their lives.[1,2] Among those, a significant majority experience non-specific or mechanical LBP, characterized by pain without identifiable pathology.[3-7] Clinical guidelines emphasize the importance of non-pharmacologic interventions for managing LBP, particularly exercise therapy and spinal manipulative therapy (SMT). This evidence suggests that SMT can effectively reduce pain and improve function for both acute and chronic NSLBP. Despite its established benefits, particularly in improving lumbar range of motion in the sagittal plane, gaps remain in not only understanding its long-term effectiveness but also comparing the effectiveness of each technique, highlighting the need for further research.[5]

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Briefly, SMT is a kind of passive treatment including manipulation and mobilization, which aim to relieve pain and improve range of motion (ROM).[8] Spinal mobilization is performed as a low-velocity, non-thrust approach whereas spinal manipulation is perform as a small amplitude high-velocity thrust approach toward the end of range or just beyond a joint movement. As a result spinal mobilization is particularly valued for its safety and gentler application, making its suitable for diverse patient populations.[6,7] Studies have investigated the effectiveness of the use of spinal mobilization in the treatment of NSLBP patients.[9-11] It has been noted that pressure applied in the posteroanterior (PA) direction to the most symptomatic spinal level resulted in pain relief[9-12] and improved lumbar range of motion (LROM) in the sagittal plane.[11,12] Despite studies reporting on the use of SMT, the effectiveness of its use in practice remains unclear.

The use of SMT to treat NSLBP has been proposed based on the patient's clinical presentation or symptom distribution.[8] For example, for a patient presenting with unilateral NSLBP, lumbar contralateral rotation, and unilateral posteroanterior (uniPA) mobilization are recommended as the first choice for optimal treatment outcomes.[8] With regards to the lumbar rotation mobilization, the applied force produces a rotation moment from the pelvis to the spinal column. This primarily produces movement in the transverse plane. When the spine is moved toward the end of the joint ROM, it secondly produces movement in the sagittal plane or PA glide of the superior articular facet in relation to the inferior articular facet. With regards to the uniPA mobilization, the force is applied in the vertical direction to the superior articular facet on the inferior articular facet of the lumbar spine. This primarily produces movement in the sagittal plane. When the spine is moved toward the end of the joint ROM, it secondly produces movement in the transverse plane. The difference between these articular movements raises the question of whether the two techniques produce similar effects in the treatment of NSLBP patients.

A few studies investigated the effectiveness of the McKenzie method in the treatment of chronic NSLBP.[13-16] It has been noted that the McKenzie method had greater improvements in LBP intensity[13,14] and disability.[15] Briefly, the Mckenzie method has been prescribed as repeated exercised in a sustained position.[16] Consequently, the Mckenzie method would normally produce movement in sagittal movement similar to the uniPA mobization. However, there is no study comparing the effectiveness of these two approaches.

Up to present, there is no study comparing these two mobilization techniques against a placebo treatment to identify its true effectiveness. Therefore, this study aimed to investigate (I) the immediate and latent effects of the lumbar mobilization technique on LBP intensity and LROM in the treatment of unilateral NSLBP patients and (II) any continuing effects on LBP intensity and LROM within 2 days after the application of SMT.

Materials and methods

Study design

A single-blinded, randomized, placebo-controlled trial was used to compare the effectiveness of lumbar contralateral rotation to uniPA mobilization in the treatment of unilateral NSLBP patients. This trial was registered with the Thai Clinical Trials Registry (TCTR20181018001). Ethical approval was provided by the Research Ethics Review Committee for Research Involving Human Research Participants, COA No.203/2018.

Participants

NSLBP patients presenting with unilateral symptoms, who had never been treated with physical therapy and first presented for LBP treatment at the Health Science Service Unit, Chulalongkorn University were invited to participate. The patients were screened using the inclusion criteria: 1) aged 20–55 years, 2) unilateral symptoms of NSLBP at rest of more than 25 on a 0-100 mm visual analog scale (VAS), 3) no radicular symptoms in the lower limbs, 4) not taking any medications (including non-steroidal anti-inflammatory drugs, muscle relaxants, and pain relief) within 24 hours, and 5) no history of lumbar spine fracture or any spinal surgery. The patients were excluded if they had any contraindications to mobilization.[8] The unilateral NSLBP patients who met the inclusion criteria were then explained the details of this study. The patients who agreed to participate were then asked to give written consent. Based on the assumption of normality, a sample of 30 could be assumed to be normally distributed.[17] Therefore, the sample size was set at a total of 60 participants.

Therapists

Two physical therapists enrolled in the Master of Physical Therapy program at the Faculty of Allied Health Sciences, Chulalongkorn University, were involved in this study. The first therapist was trained to manually assess and apply mobilization techniques by an experienced physical therapist with clinical experience in the use of SMT of more than 30 years follow Maitland's concept.[8] A bathroom scale and a metronome were used to train the application of force range and speed, respectively. The first therapist was responsible for recruiting participants, screening eligible participants, defining appropriate treatment details, treating all participants and preparing concealed allocation envelopes. The concealed opaque envelope was prepared prior to the study using a random function in Microsoft Excel Program (Version 2016). The second therapist, who was blinded to the treatment group, was responsible for establishing the baseline measurements and post-intervention outcomes.

Outcome measurements

LBP intensity

All participants were asked to report their perceived pain intensity, both at rest and on the most painful movement, using the VAS: the left side represented no pain, and the right represented pain as bad as possible.[18] Test-retest reliability has been reported to be high for the

VAS, with an intraclass correlation coefficient [$ICC_{(3,1)}$] of 0.71-0.99.[19] The minimum clinically important difference (MCID) of pain on the VAS has been noted at 20 mm on a 100-mm scale.[18]

LROM

The Back Range of Motion™ (BROM II; Performance Attainment Associates, Roseville, Minn., USA) instrument was used to measure the LROM, comprising flexion, extension, left and right lateral flexion, and left and right rotation. All measurements were conducted following a standardized protocol described elsewhere.[20] Briefly, all participants received a full explanation of measuring lumbar movements from a 4-minute video clip before the measurement. They were asked to practice all lumbar movements, using consistent verbal instruction.

The intra-rater and inter-rater reliability of LROM procedures using the BROM II have been investigated.[20] The intra-rater reliability [$ICC_{(3,1)}$] was good to excellent, ranging from 0.82 to 0.98, except for the LROM in the right rotation, which was moderate to good, ranging from 0.74 to 0.97. The inter-rater reliability [$ICC_{(2,1)}$] was good to excellent, ranging from 0.78 to 0.87. The standard error of measurement and minimal detectable change (MDC) were, respectively, less than 2.0 and 5.6 degrees in flexion, 1.7 and 4.6 degrees in extension, 1.7 and 4.7 degrees in lateral flexion, and 1.0 and 2.8 degrees in rotation.[20]

Disability

The Thai version of the Functional Rating Index (Thai-FRI) was used to assess physical disability due to LBP.[21] The Thai-FRI rating was converted into a percentage. The test-retest reliability coefficient was 0.82. The intraclass correlation coefficient [$ICC_{(3,k)}$] was 0.99.[22] The MDC and MCID of the Thai-FRI for LBP were 2.5 and 11.5 points, respectively.[21,23]

Patient satisfaction

The Global Perceived Effect (GPE) scale was used to measure the patients' satisfaction with treatment outcomes.[18] The GPE was noted using a 7-point scale ranging from -3 (worse than ever) to 3 (completely recovered). The MCID of the GPE is "2 (much improved)".[18]

Procedures

The first therapist assessed the participants subjectively and objectively. The second therapist, who was blinded to the intervention, was then called to note the baseline data (O1), comprising pain intensity, LROM, and disability. After completion of the O1, the participants were randomly allocated using random function in Excel program to generate a random number. These numbers were then sorted with respect to the group interventions. The assigned group was then put into a concealed opaque envelope and assigned the participant into either rotation or uniPA group. All participants in both groups received a detuned short-wave diathermy technique as a placebo for 10 minutes, either in a side-lying or supine position. Room temperature as well as light of the treatment area were all controlled. This placebo treatment was used in low back pain placebo-controlled trials to ensure the effectiveness of blinding and minimizing potential bias.[13] The after-placebo data (O2) were then noted, including pain intensity, LROM, and patient satisfaction.

The first therapist applied the mobilization technique, according to the assigned group in the concealed envelope, as two sets of 1-minute repetitions directly to the symptomatic spinal level. Briefly, the mobilization was applied by rotating the participant's small pelvic oscillatory movements away from the painful side while they lay on the painless side. UniPA mobilization was applied to the superior articular facet of the lumbar spine in the prone position. The details of these techniques and grade of treatment are described in detail elsewhere.[8] After the application of two sets of mobilization, the participants were asked to rest for 5 minutes. The third outcome measures (O3), including pain intensity, LROM, and patient satisfaction, were then noted. The participants were called into the clinic within 2 days to collect the fourth outcomes of follow-up data (O4), including pain intensity, LROM, patient satisfaction, and disability.

Data analysis

All data were analyzed using SPSS version 22 for Windows. The Kolmogorov-Smirnov test was conducted to ensure that the distributions of the investigated variables met the assumptions of normality for the planned parametric tests. The participants' demographic data and baseline characteristics were compared between groups using the independent *t*-test and Chi-square test. The effects of the placebo treatment were investigated by comparing the pre-intervention data (O1) and after-placebo data (O2) using the paired *t*-test. The mean and standard deviation of the change score, calculated by subtracting the pre-intervention scores from the post-intervention scores, were obtained for each variable except patient satisfaction. The immediate (O2-O3) and latent effects (O2-O4) were investigated by comparing the change scores of LBP and LROM using two-way mixed repeated ANOVA. Flare-up effects were investigated by comparing the pain intensity and LROM from the after-mobilization data (O3) with follow-up data (O4) using the paired *t*-test.

To investigate the effectiveness of the intervention on disability, the paired *t*-test was used to compare the effect of the intervention on the Thai-FRI score. To investigate the effectiveness of the intervention on patient satisfaction, the proportion of participants who reported GPE in each group was calculated.

Results

Sixty-eight unilateral NSLBP patients were recruited. Eight were excluded due to the current intensity of their LBP being less than 25 mm on the VAS. A total of 60 participants (16 men and 44 women) were recruited. The participant selection flow is shown in Figure 1. The Kolmogorov-Smirnov tests indicated the normal distribution of data for all variables with $p>0.05$. The participants' demographic

data and baseline characteristics are shown in Tables 1 and 2, respectively. No significant difference existed between groups in the participants' demographic data and baseline characteristics (p>0.05), except pain at rest (p=0.015).

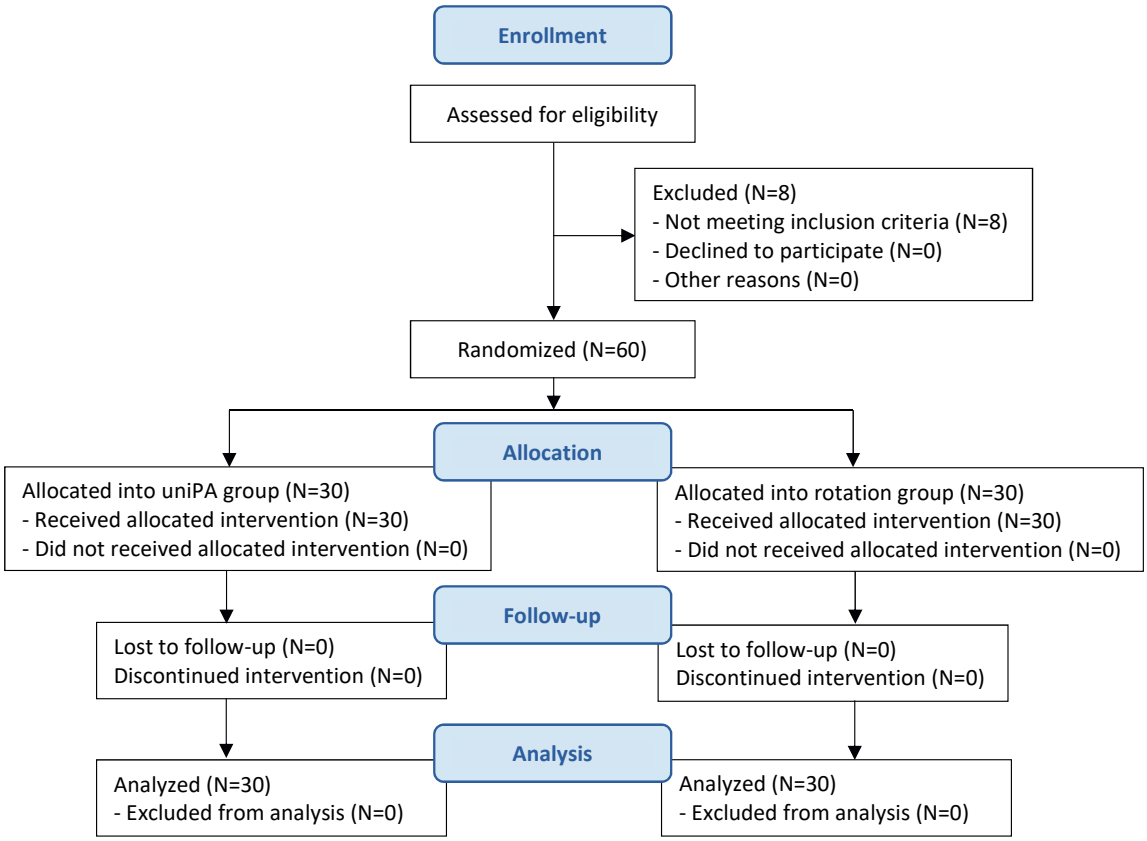


Figure 1. *The participant selection flow.*

Table 1. Demographic data (Mean±SD).

	Rotation group (N=30)	UniPA group (N=30)	*p* value
Gender (N): Male/Female	8/22	8/22	1.000[b]
Age (years)	31.0±10.1	35.8±11.9	0.098[a]
Height (m)	1.6±0.1	1.6±0.1	0.821[a]
Weight (kg)	59.8±11.8	61.9±13.2	0.515[a]
Duration (days)	335.0±593.8	605.6±956.7	0.194[a]
Symptomatic spinal level (N)			
Upper lumbar/Lower lumbar	5/25	9/21	0.532[b]
Grade (N): Grade III/Grade IV	1/29	2/28	1.000[b]
Side (N): Right side/Left side	16/14	16/14	1.000[b]

Note*: [a]analysis using independent t-test, [b]analysis using Chi-square test.*

Table 2. Baseline characteristics (Mean±SD).

	Rotation group	UniPA group	*p* value [a]
Thai version of Functional rating index (%)	36.6±10.8	42.7±13.9	0.071
Back pain intensity (mm)			
Pain at rest	47.5±14.1	56.9±15.0	0.015*
Pain on worst movement	57.0±17.9	63.4±17.0	0.159
Active lumbar range of motion (degrees)			
Flexion	24.0±5.0	21.1±8.4	0.120
Extension	4.5±4.1	3.1±2.2	0.100
Contralateral lateral flexion	23.6±6.7	21.7±6.3	0.253
Ipsilateral lateral flexion	23.3±7.3	21.5±7.7	0.338
Contralateral rotation	7.8±2.6	7.1±2.3	0.294
Ipsilateral rotation	7.3±3.0	6.6±2.7	0.372
Direction of worst movement (N)			
Sagittal plane	19	17	
Frontal plane	6	9	
Transverse plane	5	4	

***Note**: *p<0.05, [a]analysis using independent t-test.*

Back pain intensity and LROM

Concerning the placebo effect, no statistically significant differences were found in back pain intensity or LROM between O1 and O2. The results of two-way mixed repeated ANOVA are shown in Tables 3 and 4. No statistically significant difference existed in the interaction between group and time (both immediate and latent effects) on back pain intensity [$F_{(2,116)}$ ranged from 1.79 to 2.08, p=0.130 to 0.171] or LROM [$F_{(2,116)}$ ranged from 0.04 to 1.04, p=0.356 to 0.957; Table 4]. However, statistically significant within-group differences existed for immediate and latent effects on back pain intensity [$F_{(2,116)}$ ranged from 61.62 to 68.01, p< 0.001] and LROM [$F_{(2,116)}$ ranged from 31.66 to 48.66, p< 0.001] in all directions. As shown in Table 3, both techniques decreased back pain intensity and increased LROM in all directions at the immediate and latent effect intervals compared to the baseline. Additionally, pain at rest in the uniPA group was lower at the latent effect point than the immediate effect point.

Concerning flare-up effect after the lumbar mobilization technique, Table 5 shows the paired *t*-test results. Statistically significant differences were found between O3 and O4 in pain at rest and lumbar extension in the uniPA group (p=0.003 and 0.026, respectively).

Table 3. Change scores between data for back pain intensity and LROM (Mean±SD).

Variables	Rotation group		UniPA group	
	Immediate effect[#]	Latent effect[#]	Immediate effect[#]	Latent effect[#]
Back pain intensity (mm)				
Pain at rest	17.5±11.0	19.6±19.7	15.0±10.1	25.5±17.4[a]
Pain on worst movement	26.0±14.8	22.1±21.1	22.3±15.5	27.6±21.2
LROM (degrees)				
Flexion	-2.9±3.2	-2.5±3.0	-4.2±3.8	-3.6±4.5
Extension	-1.8±1.6	-1.7±2.2	-2.4±1.8	-1.7±1.4
Contralateral lateral flexion	-4.1±3.2	-3.3±4.0	-4.1±3.4	-3.1±3.6
Ipsilateral lateral flexion	-3.8±2.6	-3.6±4.1	-3.0±2.9	-4.0±3.8
Contralateral rotation	-2.0±1.6	-1.6±1.6	-2.4±1.8	-1.9±2.0
Ipsilateral rotation	-2.0±1.7	-1.7±2.2	-2.5±1.5	-1.9±2.1

***Note**:[#]significant difference when compared to baseline in each group (p<0.05),[a]significant difference when compared to immediate effect in each group (p<0.05), A negative sign for the change scores represents an increase in LROM.*

Table 4. Effects of group, time, and interaction between group and time on back pain intensity and LROM.

Variables	Group effect		Time effect		Interaction effect	
	$F_{(1,58)}$	*p* value	$F_{(2,116)}$	*p* value	$F_{(2,116)}$	*p* value
Back pain intensity (mm)						
Pain at rest	0.29	0.593	61.62	<0.001*	2.08	0.130
Pain on worst movement	0.05	0.824	68.01	<0.001*	1.79	0.171
LROM (degrees)						
Flexion	2.21	0.143	31.66	<0.001*	1.04	0.356
Extension	0.59	0.445	45.80	<0.001*	0.78	0.462
Contralateral lateral flexion	0.05	0.831	41.96	<0.001*	0.04	0.957
Ipsilateral lateral flexion	0.07	0.787	41.61	<0.001*	0.80	0.452
Contralateral rotation	0.78	0.381	48.66	<0.001*	0.38	0.688
Ipsilateral rotation	0.64	0.426	42.76	<0.001*	0.41	0.663

***Note**: *p<0.001, analysis using two-way mixed repeated ANOVA.*

Table 5. The result of follow-up effect within 2 days on back pain intensity and LROM (Mean±SD).

Variables	Rotation group				UniPA group			
	After mobilization	Follow-up within 2 days	*t*	*p* value	After mobilization	Follow-up within 2 days	*t*	*p* value
Back pain intensity (mm)								
Pain at rest	29.1±16.3	27.0±19.4	0.60	0.551	37.4±19.1	27.0±19.8	3.26	0.003*
Pain on worst movement	28.1±19.4	32.0±20.4	-1.03	0.314	37.9±21.4	32.6±21.2	1.59	0.123
LROM (degrees)								
Flexion	25.8±5.3	25.4±4.9	0.59	0.559	34.4±8.2	23.9±7.5	0.73	0.471
Extension	6.1±4.1	6.0±3.7	0.42	0.679	5.3±2.5	4.7±2.2	2.35	0.026*
Contralateral lateral flexion	26.9±5.8	26.1±5.8	1.24	0.227	25.3±6.6	24.3±7.0	1.35	0.188
Ipsilateral lateral flexion	25.7±7.0	25.5±6.4	0.26	0.794	24.0±6.9	24.9±7.6	-1.53	0.138
Contralateral rotation	9.7±2.2	9.3±2.1	1.10	0.281	9.3±1.7	8.8±2.0	1.55	0.133
Ipsilateral rotation	9.4±2.8	9.1±2.6	0.68	0.502	9.4±1.9	8.8±2.1	1.39	0.174

***Note**: *p<0.05, analysis using paired t-test.*

Thai-FRI and GPE

No significant difference existed in the change in Thai-FRI scores between groups (p=0.937). A significant difference was found between pre-intervention and post-intervention scores in both groups (p<0.001; Table 6).

The GPE scores were grouped into three groups. Score 2 to 3, -1 to 1, and -2 to -3 were defined as improved, unchanged and worsened, respectively. The number and proportion of participants with each score on the GPE post-intervention are shown in Table 7. More than 90% of participants in both groups reported an unchanged GPE at the placebo effect. Approximately 43% of the participants in the rotation group reported an improved GPE at the immediate and follow-up effects. Approximately 93% of participants in the uniPA group reported an unchanged GPE at the immediate effect, and 57% of the participants reported an improved GPE at follow-up.

Table 6. The result of Thai-FRI scores (Mean±SD).

	Pre-intervention	Post-intervention	Change	Within group*		Between group**	
				t	*p* value	*t*	*p* value
Rotation group	36.75±10.83	23.58±13.19	13.17±12.51	5.77	<0.001	-0.80	0.937
UniPA group	42.67±13.91	29.25±13.74	13.42±11.77	6.24	<0.001		

***Note**: *analysis from pre-intervention and post-intervention using paired t-test, **analysis from change percentage using independent t test.*

Table 7. Number and percentage of participants who rated on GPE.

GPE	Rotation group						UniPA group					
	Placebo (N)	%	Immediate (N)	%	Follow-up (N)	%	Placebo (N)	%	Immediate (N)	%	Follow-up (N)	%
3 = Completely recovered	-	3.3	1	43.3	1	43.3	-	6.7	-	0.00	1	56.7
2 = Much improved	1		12		12		2		-		16	
1 = Slightly improved	4	93.3	15	56.7	5	56.7	7	93.3	14	100	11	43.3
0 = No change	22		2		7		19		2		2	
-1 = Slightly worsened	2		-		5		2		14		-	
-2 = Much worsened	1	3.3	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00
-3 = Worse than ever	-		-		-		-		-		-	

Discussion

The statistical analysis reviewed no significant differences between groups in demographic data (p>0.05) or baseline characteristics (p>0.05), except pain at rest at the baseline (p=0.015). The difference between groups in pain at rest at the baseline did not affect the overall results because the data were normalized using the change score between the pre- and post-intervention points.[24]

The statistical analysis reviewed no significant results with the placebo treatment. This supports the later results, which should not be contaminated by psychological effects. The results of this study demonstrated that both lumbar contralateral rotation and uniPA mobilization techniques are effective in reducing pain and improving LROM in patients with unilateral NSLBP (p<0.001). However, no significant differences existed between groups in back pain intensity after receiving mobilization. Based on the sample size on each group (N=30), a power of analysis noted power and effect size ranged from 0.99-1.00 and 0.81-0.89, respectively. While a sample size of 60 (between group), a power of analysis noted power and effect size ranged from 0.63-0.71 and 0.21-0.32, respectively. It would be possible that the within group effects noted significant differences in both pain reduction and improving in range of motion, therefore the between groups effect would not be noted in such sample size. Further studies are required to confirm the between group effects in either a larger sample size or various LBP duration.

The hypoalgesic effects noted in within groups effects would be explained by neurophysiological mechanism.[25-27] These results noted on significant differences on immediate and flare-up effects on pain at rest and pain on worst movement in both groups, supporting the immediate and latent neurophysiological mechanism proposed by Wright.[26] Interestingly, significant within-group difference was found in the time effect. LBP intensity was reduced at the latent effect interval by more than 20 mm only in the uniPA group, which is considered clinically relevant.[18] This would be the case that the uniPA mobilization may have been applied directly to the facet joint, which would cause the symptoms resulting in changed mechanical properties of the spine.[6] This finding is consistent with a study by Latimer *et al*., which noted an association between LBP and spinal stiffness: spinal stiffness decreased as spinal pain decreased.[28]

No significant between-group differences existed in LROM. Although the change in LROM was statistically significant within groups, the mean change was less than the MDC (ranging from 2.8 to 5.6 degrees).[20] This may imply that the LROM change score is not clinically relevant. Several explanations are possible. For example, most of the participants in this study had chronic symptoms, and the majority had stiffness problems. Due to the chronic stage, the extensibility of the connective tissue might be decreased as it becomes stiffer.[9] Therefore, a single session of treatment would not be sufficient to effectively increase LROM.[9]

Interestingly, the greatest immediate improvements in LROM in lumbar contralateral lateral flexion and lumbar flexion were noted in the contralateral rotation group and uniPA group, respectively. These findings are consistent with a previous study and can be explained biomechanically.[12] The rotation mobilization produces movements in the transverse plane and then movement in the sagittal plane via PA gliding of the superior articular facet on the inferior articular facet. Consequently, it could promote movement of the lumbar spine in the transverse plane, coupled with movement in the frontal plane, increasing contralateral lateral flexion. UniPA mobilization produces movement on the sagittal plane and then movement in the transverse plane. Consequently, it could promote movement of the lumbar spine in the sagittal plane, resulting in increased flexion.

More than 90% of the participants in both groups reported an unchanged GPE after receiving a detuned SWD technique. More than 40% of the rotation group and none of the uniPA group reported an improved GPE after the intervention. The difference in the contact area may have caused discomfort to participants in the uniPA group but not the rotation group.[29] However, the participants in the uniPA group reported improved LBP compared to the rotation group at follow-up within 2 days. This may have resulted from a direct alteration of biomechanical properties during the application of uniPA, which contralateral rotation did not involve.

These results provide useful information to assist novices in precisely choosing a mobilization technique as the first choice of treatment in clinic. The results suggest that both techniques are effective in treating unilateral NSLBP patients. Therapists should firstly choose the lumbar

contralateral rotation technique to treat patients who mostly limit lumbar contralateral lateral flexion, whereas they should choose the uniPA technique to treat patients who mostly limit lumbar flexion. The lumbar contralateral rotation technique may be suitable for patients with high pain intensity at rest to achieve immediate alleviation and patient satisfaction. When the LBP intensity at rest is subsided, the uniPA technique would be selected to alleviate flare-up effects. However, if the use of one technique does not give the desired results, a clinician may apply another technique or approach to achieve their treatment goal.

This study used two-way mixed repeated measure with self-control to prevent bias; therefore, both treatment conditions were equivalent for the research setting.[24] However, this study had potential limitations. First, this study did not control daily activities of each participant during the data collection process. It was assumed that individual perception of pain relief would produce the satisfaction of participants after the treatment and thus allow them to perform more load on their daily activities. Difference latent findings might be noted if a further study limit such activities. Second, the participants were treated with only one session of the mobilization. Thus, it is possible that pursuing a course of mobilization might demonstrate different findings. Next, the participants were recruited from the LBP patients with various pain duration. Further studies should add more specific pain duration of the LBP patients that might lead to different findings. Lastly, the participants were treated using mostly grade IV applied to the lower lumbar spinal level, difference findings might be noted in the use of difference grades and treated area.

Conclusion

These results suggest that the selection of mobilization techniques should be based on the symptom distribution in patients with NSLBP. The findings partially support Maitland's recommendation of using mobilization techniques in the treatment of patients with unilateral symptoms.[8] UniPA mobilization showed flare-up effects within 2 days regarding pain alleviation at rest compared to after the mobilization.

Conflict of interest

The authors declare no conflict of interest.

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