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Effect of stabilization, walking, and flexibility exercise on lumbar lordosis and low back pain

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Objective
The aims of this study were to determine whether lumbar stabilization exercise, walking exercise, and flexibility exercise contribute to the improvement of lumbar lordosis, and whether the improvement of lumbar lordosis is correlated with the alleviation of chronic low back pain.

Method
This study was conducted on 32 participants prospectively, who were over 20 years old and suffered from chronic (> 3 months) low back pain, between May 2016 and April 2017. Participants were randomly assigned to three groups; lumbar stabilization, walking, and flexibility exercise programs. And each group participated in an assigned exercise program for a total of 6 weeks, five days a week, 30 minutes a day. The lumbar stabilization exercise group carried out individualized graded lumbar stabilization exercise program, which consisted of stretching and stabilization exercise. The walking exercise group performed a quick 30-minute walk through the flat surface with abdominal bracing, and the flexibility exercise group performed stretching exercises. Both before and after 6-week exercise programs, lumbosacral x-rays were checked for each participant. Researchers measured lumbar lordosis with lumbosacral x-rays and assessed the degree of low back pain and radiating pain by using visual analogue scale (VAS) at two time points. To confirm significant differences in lumbar lordosis before and after exercise, paired t-test and Wilcoxon signed rank test were used. Spearman's rank correlation analysis was used to evaluate the correlation between changes in lumbar lordosis and changes in low back pain and radiating pain, before and after exercise.

Results
32 participants were included in analysis, with eleven in lumbar stabilization exercise group, ten in walking exercise group and eleven in flexibility exercise group. Compared to before starting exercise, lumbar lordosis in all participants was increased by 2.8 degree (mean value, p=0.075) after performing 6-week exercise programs. Although not statistically significant, the analysis by each group also found an increase in lumbar

lordosis after performing each program and walking exercise group showed a greater increase in lumbar lordosis than other groups. In terms of the correlation between low back & radiating pain and lumbar lordosis, there was no significant correlation in all groups between the changes in lumbar lordosis and changes in low back & radiating pain before and after exercise, except for negative correlation between the changes in lumbar lordosis in flexibility exercise group and the changes in low back pain in worsening condition (rho=-0.611, p=0.046).

Conclusion

Our findings imply that all three exercises may contribute to increasing lumbar lordosis, and walking exercise may have a greater effect on the improvement of lumbar lordosis than other exercises. Further studies are needed with larger study populations to evaluate the correlation between lumbar lordosis and chronic low back pain.

Table 1. The changes of lumbar lordosis and pelvic incidence in all participants after 6-week exercise programs.

	All (n=32)		
	Pre	Post	*p* value
Lumbar lordosis (deg.)	42.7 (12.4)	45.5 (9.6)	0.075
Pelvic incidence (deg.)	51.0 (8.8)	51.8 (8.9)	0.425

Values are mean (SD).
p values were calculated by paired t-test.

Table 2. The changes of lumbar lordosis and pelvic incidence in each group after 6-week exercise programs.

	Stabilization exercise (n=11)			Walking exercise (n=10)			Flexibility exercise (n=11)		
	Pre	Post	*p* value	Pre	Post	*p* value	Pre	Post	*p* value
Lumbar lordosis (deg.)	38.9 (13.6)	41.6 (10.8)	0.248	42.6 (14.2)	46.3 (8.5)	0.139	46.6 (8.6)	48.7 (8.5)	0.424
Pelvic incidence (deg.)	47.8 (9.9)	47.9 (7.9)	0.477	53.0 (8.4)	52.2 (9.5)	0.508	52.3 (7.9)	55.3 (8.3)	0.110

Values are mean (SD).
p values were calculated by Wilcoxon signed rank test.
SE, Stabilization exercise ; WE, Walking exercise ; FE, Flexibility exercise

Table 3. Correlation between lumbar lordosis and pain before and after 6-week exercise programs.

	Stabilization exercise (n=11)	Walking exercise (n=10)	Flexibility exercise (n=11)
	Difference of lumbar lordosis before and after exercise (deg.)		
LBP in resting (post-pre)	-0.203 (p=0.600)	0.034 (p=0.932)	-0.458 (p=0.157)
LBP in worsening condition (post-pre)	-0.075 (p=0.847)	0.341 (p=0.334)	-0.611 (p=0.046)
Radiating pain in resting (post-pre)	0.185 (p=0.634)	-0.492 (p=0.179)	-0.105 (p=0.758)
Radiating pain in worsening condition (post-pre)	0.395 (p=0.293)	-0.259 (p=0.500)	-0.326 (p=0.327)

Statistical significance was evaluated by Spearman's rank correlation analysis.
Post (after 6 weeks) – Pre (baseline) difference value was used to analyze correlation between lumbar lordosis and pain before and after 6 weeks exercise programs.
LBP, low back pain