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Effect of static hip flexor stretching on standing pelvic tilt and lumbar lordosis

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Effect of Static Hip Flexor Stretching on Standing Pelvic Tilt and Lumbar Lordosis

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Abstract

PURPOSE: The purpose of this study was to determine if an acute bout of static stretching of anterior hip muscles would result in a change in sagittal pelvic and lumbar positions in the standing position in a healthy, non-acrobat sample. METHODS: Adult participants (18-40yrs) were asked to stand with arms overhead, aligning their body as vertically straight as possible. To assess lumbar and pelvic position, reflective markers were placed on vertebral levels T7, T12, and L4, as well as the anterior superior iliac spine (ASIS), posterior superior iliac spine (PSIS), and the greater trochanter of the femur. Photographic images of the straight-standing position were taken before, and following a stretching intervention for the anterior hip musculature. The stretching intervention consisted of a half-kneeling forward lunge position, performed for 30 sec each leg for three repetitions each. Freeware (ICMeasure) was used to digitize the reflective markers and calculate lumbar lordosis and pelvic tilt. Two paired t-tests (SPSS v.24) were used to determine if significant differences occurred in lumbar lordosis and pelvic tilt before and after the intervention. RESULTS: Following stretching, participants were able to significantly increase their posterior pelvic tilt ($t = 0.002$, $p < 0.05$) by one method of measurement (Perry), but using the method of Crowel resulted in a non-significant change. Lumbar lordosis was also non-significant.

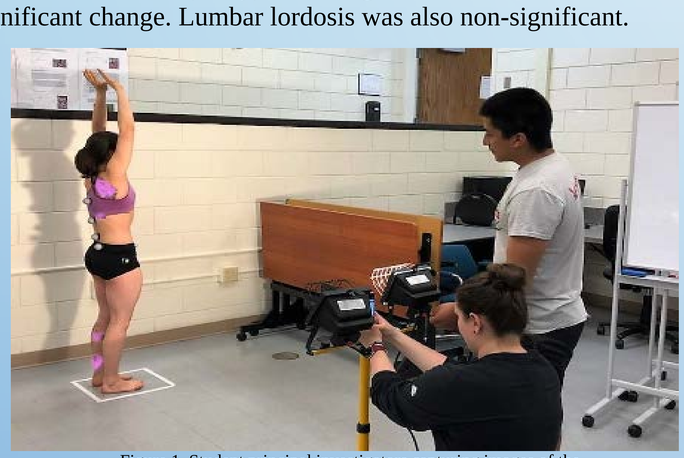

Figure 1. Student principal investigators capturing images of the standing position used for analysis

Introduction

It is established in the research literature that sagittal plane pelvic position is closely related to lumbar spine position. In particular, anterior pelvic tilt is associated with an increased lordosis of the lumbar spine, while posterior pelvic tilt is related to reduced lordosis (e.g. Day et al., 1984; Levine & Whittle, 1996). Pain and dysfunction of the lumbar spine has been shown to be related to increased or excessive lumbar lordosis, especially during upright positions such as standing. It is also documented that individuals can actively change their pelvic tilt and lumbar lordosis through muscle contraction (e.g. Hayden et al., 2018). Stretching and/or flexibility have also been related in some studies to habitual standing positions (e.g. Muyor et al., 2011). A critical posture for acrobatic athletes requires that the body be as vertically-aligned as possible. Minimizing anterior pelvic tilt and lumbar lordosis are important for achieving this posture. This study was interested in whether stretching of muscles which pull the pelvis into anterior tilt would acutely affect standing posture. The standing posture investigated was an 'active' posture, whereby participants were asked to actively attempt to achieve a straight-body position.

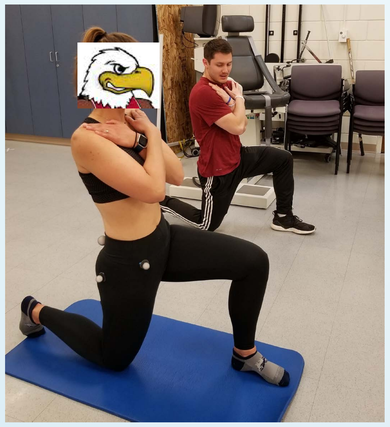

Figure 2. Instructing a participant in the half kneeling stretch

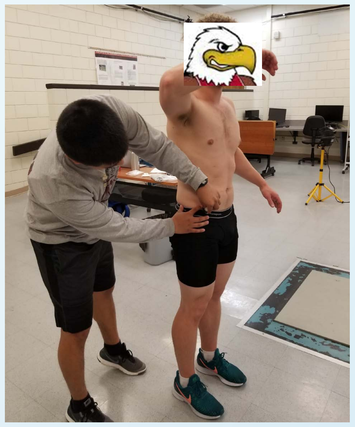

Figure 3. Placement of reflector markers on a participant

Methods

Participants were excluded if they had an upper extremity or a lower body injury that would effect their ability to achieve the required stretching or standing position. Participants were shown the desired straight-standing position, which consisted of holding arms straight overhead while posteriorly tilting the pelvis to minimize lumbar lordosis. Participants then performed a 5 min warm-up of moderate cycling on a stationary bike. Reflective markers were placed on vertebral levels T7, T12, and L4, as well as the ASIS, PSIS, and the greater trochanter of the femur. With markers placed, participants stood in the straight-body position while photographic images were taken from a lateral view. Following the pre-test, participants performed the stretching intervention which consisted of a half-kneeling forward lunge position, performed for 30 sec each leg for three repetitions each (Winters et al., 2004). Following the stretching intervention, participants again stood in the standing straight-body position while lateral view images were captured. Freeware (ICMeasure) was used to digitize the reflective markers and calculate lumbar lordosis and pelvic tilt. Table 1 presents the definitions and landmarks of the three angles measured. Two paired t-tests (SPSS v.24) were used to determine if significant differences occurred in lumbar lordosis and pelvic tilt before and after the intervention.

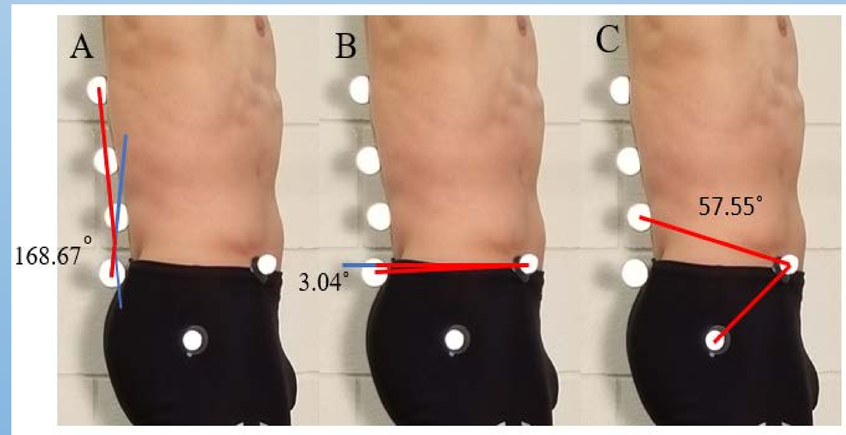

Figure 4:Image A measurement of the LUM_M angle, Image B measurement of the PT_C , and Image C LUM_P

Results

Sixteen participants with mean age of 23.88± 3.88 years. Participants averaged 2 days per week of stretching the lower body and averaged 3-4 minutes per session. Participants averaged one day per week stretching the lower back with an average of 1-2minutes per session

Table 1

Results of paired sample t-tests and Descriptive Statistics Pre/Post Pt_c, LUM_p, LUM_m

	Group						
	Pre		Post		Pre - Post		
Outcome	*M*	*SD*	*M*	*SD*	Mean Difference	*t*	*p*
PT_c	8.09	5.09	7.25	5.51	0.85	0.95	.360
LUM_p	57.83	8.52	56.07	8.61	2.74	3.72	.002*
LUM_m	151.99	11.58	150.13	12.28	1.87	1.05	.311

Note: n=16; * $p < .05$.
(PT_c) Crowel pelvic tilt landmarks: ASIS, PSIS, and a horizontal line through the ASIS
(LUM_P) Perry lumbar lordosis included the landmarks: L4, ASIS, and greater trochanter
(LUM_M) McNeal lumbar lordosis included the landmarks: T7, T12, L4, and PSIS

Discussion

A significant difference was found in LUM_M angle between the pre and post stretch, with a reduction of the angle indicative of increasing posterior pelvic tilt. The results for the PT_C and LUM_M were not statistically significant possibly due to the minimal difference between the pre and post being within the digitizing error. Participants were able to significantly increase the LUM_M angle, reducing lumbar lordosis and were able to increase posterior tilt from stretching. Based upon these results we can say that acute stretching of anterior hip muscles had an affect of increasing posterior tilt in these participants. The measure used for lumbar lordosis however, did not show a change. The information from this study could be beneficial towards athletic populations, the elderly, and any individual who may have excessive lumbar lordosis and anterior pelvic tilt. Future studies should investigate if chronic stretching will lead to a larger treatment effect. Also, the effect of increasing stretching intensity should be investigated.

Limitations

Most of the participants were in the field of exercise science or health and fitness. Individuals in these programs are more than likely to engage in physical activity. Also, the age range of the participants was under 35 years old, so there was a lack of representation of older populations. Another limitation was that more than one researcher placed markers on participants involving human error of marker placement. Even though landmarks were doubled checked there was not a consistency between each participant and placement of markers.

References

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