Mid Atlantic Regional Chapter
of the
American College of Sports Medicine

AMERICAN COLLEGE of SPORTS MEDICINE. Mid-Atlantic Chapter

Annual Scientific Meeting, November 4^{th}- 5^{th}, 2017
Conference Proceedings
International Journal of Exercise Science, Issue 9, Volume 6

Manipulation of Retrograde Shear in the Superficial Femoral Artery in Recreationally Active and Exercise-Trained Men

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Retrograde shear stress increases with age and contributes to atherosclerosis. Habitual exercise has been shown to ameliorate the effects of age on cardiovascular disease possibly due to favorable vascular remodeling and reductions in retrograde shear. **PURPOSE**: Examine whether the vascular remodelling from habitual exercise training affects retrograde shear at rest and during a manipulation designed to alter shear (lower limb compression) in young adults. **METHODS**: Doppler ultrasound was used to measure superficial femoral artery (SFA) diameter and retrograde shear rate in 11 exercise-trained men (Division I track athletes; 20 ± 3 years of age, body mass index 21 ± 2 $kg\cdot m^{-2}$) and 18 recreationally active controls (23 ± 5 years of age, body mass index 23 ± 2 $kg\cdot m^{-2}$). Measures were made at rest and during a shear manipulation: inflation of a pneumatic cuff applied to the calf to 5 mmHg (sham) and 60 mmHg (experimental) in a randomized order. **RESULTS**: All results are displayed in Table 1. SFA diameter was larger in exercise-trained men versus controls ($P < 0.05$). Retrograde shear was similar between the exercise-trained men and controls at baseline and during the sham condition ($P > 0.05$). Exercise-trained men had lower retrograde shear during the experimental condition ($P < 0.05$). Group differences during the experimental condition remained after co-varying for resting retrograde shear and body mass index ($P < 0.05$). **CONCLUSION**: Manipulation of retrograde shear using lower limb compression reveals differences in shear patterns not detected at rest. Exercise-trained men have a more optimal, anti-atherosclerotic shear pattern (i.e. less retrograde shear) in comparison to recreationally active men.

Table 1. SFA diameter and shear at rest and during lower limb compression.

	Exercise-Trained	*Control*
Rest		
Diastolic diameter (cm)	0.64 ± 0.06	0.57 ± 0.06#
Antegrade shear rate (s^{-1})	170.8 ± 41.2	181.8 ± 41.7
Retrograde shear rate (s^{-1})	75.6 ± 26.6	84.4 ± 23.3
5 mmHg Condition (Sham)		
Diastolic diameter (cm)	0.64 ± 0.04	0.58 ± 0.06#
Antegrade shear rate (s^{-1})	172.1 ± 41.5	174.8 ± 44.7
Retrograde shear rate (s^{-1})	81.8 ± 14.6	89.7 ± 18.2
60 mmHg Condition (Experimental)		
Diastolic diameter (cm)	0.64 ± 0.06	0.58 ± 0.06#
Antegrade shear rate (s^{-1})	208.1 ± 36.9	227.1 ± 46.9
Retrograde shear rate (s^{-1})	88.6 ± 17.1*	106.4 ± 19.6#*

 # different from exercise-trained (p<0.05)
** different from rest (p<0.05)*