

Effect of Body Position and Activity Level on the  
Eccentric Strength of the Shoulder while performing  
the PNF D2 Extension Pattern

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The purpose of this study was to determine the effect of body position and activity level on the eccentric strength of the shoulder while performing the PNF D2 extension pattern. 8 female intercollegiate volleyball players (167.17,  $\pm$  8.60cm; 68.7,  $\pm$  7.0kg; 20.13,  $\pm$  1.46yrs), and 8 non-athletes (163.45,  $\pm$  6.13cm; 64.7,  $\pm$  16.4kg; 25.63,  $\pm$  3.89yrs) volunteered for this study. Eccentric strength testing was performed on the dominant arm using the Biodex Isokinetic Dynamometer (Shirley, NY) at 60°/s. Peak torque was assessed in the seated and supine body positions. Body position was randomized to deter any effect of a learning bias. Subjects performed a warm-up of 5 submaximal eccentric contractions, had a three-minute rest, then performed 5 maximal eccentric contractions for the test. The same procedure was followed for the second test position. The starting shoulder position was flexion, abduction, and external rotation, and finished in extension, adduction, and internal rotation. The PNF D2 extension pattern was performed through a 100° arc of motion. A 2x2 analysis of variance was used to determine significant differences of peak torque values between body position and activity level. A significant difference was found between the volleyball players and non-athletes ( $p < 0.05$ ). The difference between body positions was not significant ( $p = 0.12$ ). Because there was not a significant difference between body positions, clinicians may use the seated position as a transition between isolated strengthening (supine) and

functional strengthening (standing) for eccentric testing of overhead athletes. Some benefits of closed kinetic chain exercise are present during supine PNF testing that are advantageous to the overhead athlete in the early stages of rehabilitation, but evaluation and treatment should progress to an upright position as return to function becomes a goal.