INFLUENCE OF SHOULDER RANGE OF MOTION AND STRENGTH ON TENNIS FOREHAND VELOCITY IN COLLEGIATE ATHLETES. Schaeffer B, Brown A, Cruz H, Freeman S, Martin B, Nickerson C. Hardin-Simmons University Department of Physical Therapy, Abilene, TX.

PURPOSE: (1) To investigate the relationships between shoulder muscle strength and range of motion (ROM) to ball velocity during a tennis forehand swing. (2) To predict forehand velocity from shoulder muscle strength, range of motion, height, weight, and gender.

SUBJECTS: Thirty-nine (M=19, F=20) D-1 and D-3 collegiate level tennis players volunteered for the investigation.

METHODS: Subjects signed an IRB-approved informed consent and completed an injury history survey prior to testing. Baseline measurements included height and weight. Goniometric ROM and J-Tech Onsite Commander isometric muscle strength measurements were completed on the dominant (hitting) arm which included external rotation (ER), internal rotation (IR), and horizontal adduction (Hor Add). Following a 6-minute warm up (3-minute jog and stretch and 3-minute hitting on ball machine), subjects were fed a series of balls (from ball machine) to their dominant side for a forehand swing until three inbounds crosscourt hits were recorded. A calibrated Stalker Pro Radar Gun was used to measure ball velocity.

Statistical Analysis: Bivariate correlations (SPSS-25) were used to determine the relationships between isometric muscle strength, ROM, and maximum ball velocity. Multiple regression analysis was used to predict forehand ball velocity from standard strength and ROM measurements. Statistical significance was set at $p < 0.05$.

RESULTS: Subject demographics included height (M=176 cm ±8.6); weight (73.46 kg ±13.89); body mass index (23.77±4.34). There was a significant positive relationship between max forehand velocity and IR, ER, and Hor Add strength respectively (*r*=,.72, .80, .75). Additionally, a significant negative relationship occurred between max velocity and ER ROM (*r* = -.368) indicating the lower the ER ROM, the greater the max velocity (*r* = -.368). Strength, ROM, height, weight, gender variables along with internal rotation, external rotation, and horizontal adduction accounted for 73% the variance in ball velocity. A significant regression equation was found with (f (9,29)=17.366, $p<0.001$), with an R^2 value of 0.843. Subjects predicted maximal forehand velocity was equal to 25.895 + (0.697 x MMTIR) + (1.673 x MMTER) + (.003 x MMTHORADD) + (.259 x ROMIR) + (.207 x ROMER) + (-.405 x ROMHORADD) + (.287 x kg-wt) + (0.287 x cm-ht) + (5.747 x F=1; M=2).

CONCLUSIONS: The greater the shoulder IR, ER, and Hor Add strength, the greater the forehand velocity. Conversely, the lower the ER ROM, the greater the forehand velocity. Height, weight, gender, shoulder strength, and shoulder ROM predicts 84% of the variance associated with collegiate tennis players.

CLINICAL RELEVANCE: Based on the sample tested in the current investigation, it appears that common PT measures (ROM and MMT) can predict forehand ball velocity with reasonable accuracy. We are continuing to investigate relationships between the ratio of the shoulder IR-ER ROM, shoulder strength imbalances, and the forehand ball velocity.