

# 1 DISCRETE VS. FUNCTIONAL BASED DATA TO ANALYZE COUNTERMOVEMENT 2 JUMP PERFORMANCE

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9 While discrete point analysis (DPA) (e.g. peak power) is by far the most common  
10 method of analyzing movement data, it may have significant limitations because it  
11 ignores the vast majority of a signal's data. In response, there has been a small but  
12 growing use of methods, such as functional data analysis (FDA), which allow an  
13 investigation of the underlying structure of the continuous signal and may therefore  
14 provide a more powerful analysis. However, a direct comparison between DPA and  
15 FDA has not been previously reported. **PURPOSE:** To directly compare DPA and  
16 FDA for the identification of performance determining factors for the  
17 countermovement jump (CMJ). **METHODS:** Twenty-five male participants performed  
18 15 CMJs, and the highest jump was selected for further analysis. Joint and whole  
19 body kinematic and kinetic measures were determined using position data (Vicon,  
20 250 Hz) and force plate data (AMTI, 1000Hz). Participants were divided into good  
21 (n=10) and poor (n=10) groups based on jump height. A t-test ( $\alpha = 0.05$ ) was  
22 performed on the timing and magnitude of key variables (DPA) and functional derived  
23 points (FDA) during the propulsion phase to examine differences between the  
24 groups. **RESULTS:** Both techniques found differences ( $p < 0.05$ ) in knee angular peak  
25 velocity, CoM peak velocity, CoM peak power and CoM work done. However, the  
26 FDA alone found significant higher ( $p < 0.05$ ) ankle moment (79 - 83%, peak at 67%),  
27 ankle power (54 - 67%, peak at 81%), knee angular velocity (28 - 100%), CoM  
28 velocity (56 - 100%), CoM power (49 - 91%) and a delay in CoM position (10 - 90%)  
29 and CoM velocity (10 - 60%) for the good performance group. Finally, the DPA alone  
30 found differences in ankle peak moment, ankle peak power and hip peak angular  
31 velocity. **CONCLUSIONS:** In contrast to FDA, DPA found three events which were  
32 not detected by FDA. However, only FDA was able to identify important differences in  
33 phases of the CMJ and explains differences between good and poor performance  
34 better than DPA. Finally, the ability to examine data with continuous techniques  
35 appears to provide a deeper insight into human movement than DPA.