28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Using network science to identify the prominent court zone of tennis long rally

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INTRODUCTION:
In the process of the tennis match, the interaction between two competing players involves the decision-making of stroke, positioning and ball direction and rotation. To unveil the playing pattern within such interaction and to interpret player performance, a recent study has applied network science to the analysis of rallying in other racquet sports such as badminton. However, little has been done in tennis given it contains more constraints like ball location and wider court space. Therefore, this study aimed to construct a tennis stroke network that considers the consecutive ball placement during long rallies and to identify the prominent court zone within the network.
METHODS:
The study randomly selected 15 rallies that ended with nine and more strokes from 12 mens singles main-draw matches of the 2019 Australian Open, which contains 163 strokes, excluding the serve and return strokes. All included players are right-handed. The tennis stroke network is a paradigmatic example of a bipartite network, where nodes are grouped into two disjoint sets, with nodes of the same set devoid of a direct link between them. The size of nodes was proportional to their importance in the network, with the links' width proportional to the number of times a specific path was repeated. Therefore, a 40*40 adjacency matrix was established, with 20 zones on each player's side of the court. Finally, the centrality of each node (after transforming the corresponding nodes on both sides of the court into the same half) and frequency of all the network edges were calculated in order to evaluate zone importance and ball direction.
RESULTS:
Zone_7 (Zone_34) has the greatest degree centrality of 2.3, representing the most frequent zone where players made the strokes. It is followed by Zone_8 (Zone_33), Zone_11 (Zone_30) and Zone_5 (Zone_36), with values of 1.85, 1.75 and 1.65, respectively. Considering the zones of the baseline, the highest degree centrality is shown at Zone_4 (Zone_37) with a value of 1.2, where players used more backhand strokes. Considering the network edges, Zone_31 (Zone_10) and Zone_5 (Zone_36) are most frequently connected for forehand strokes, while Zone_7 (Zone_34) and Zone_33 (Zone_8) are most frequently connected for backhand.
CONCLUSION:
The current study provides preliminary knowledge about tennis long rally performance considering the evolution of the shot information. The findings reveal that hitting the ball to the backhand side of the opponents is the most frequent tactical choice during the long rally, given that there are more related zones of high centrality degree. Nonetheless, the edge between forehand Zone_31 (Zone_10) and Zone_5 (Zone_36) is also highly connected, probably indicating a preferred ball direction to end the point. The results explored the stroke patterns of professional tennis and the most favorable zone for players. Future researchers and analysts could adopt the method to analyze tactics and specific striking styles of individual players.

Topic: **Coaching**

Presentation **Poster**