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Forehand footwork variability in the attacking situation at elite level

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ABSTRACT

The aim of the present study was to analyze the different patterns of forehand footwork in attacking situation at elite level. 498 forehand shots played during rallies and involving forward momentum of the body during the final draw of the US Open tournament held in 2019 and 2021 were analyzed. The results highlighted 6 main footwork patterns involving distinct roles for the front leg and the back leg. In conclusion, technical analysis should consider the dynamic aspect of strokes and coaches should work on the variability of footwork in player development.

Key words: footwork, forehand, technical analysis, variability.

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INTRODUCTION

Generating high ball speed has become a determining factor for success at the elite level. After the serve, the forehand has taken a predominant role in the construction of the point. The preferential use of the forehand may be partly explained by the fact that forehand strokes produce a higher ball speed than backhand strokes for elite players (Landlinger et al., 2012).

In traditional teaching, stance is mainly defined as the static position of the feet at the end of the preparation in relation to the trajectory of the shot. Thus, 4 main variations have typically been described: open stance, semi-open stance, neutral stance and closed stance.

The evolution towards a faster game led players to hit their forehands in a variety of situations related to spatio-temporal constraints that need to define the footwork more dynamically by considering the movement of both feet and legs before, during and after contact. Indeed, a recent study has shown differences in lower limb kinematics when the player moves and hits a forehand with different input speeds (Giles & Reid, 2021). This technical variability has created a growing appreciation for a more functional approach of stroke production using the kinetic chain principle, where forces generated by the lower extremities are transferred through the trunk to the dominant arm and racket (Genevois et al., 2015).

The aim of this study was to highlight the different footwork patterns used at elite level to play a forward attacking forehand stroke in various situations.

METHODS AND PROCEDURES

Sample and variables

The sample included 498 forehand strokes from 21 ATP players (ranking 2-214) during the US Open final draw in 2019 and 2021. All the forehands were played in an attacking situation with a forward momentum of the body. For each forehand we recorded the following variables:

1. The type of footwork pattern: transfer from open or semi-open stance (TFOS), front leg forward hop (FLH), pivot (P), back leg diagonal hop (BLDH), front leg diagonal hop (FLDH), on the run (OTR); the front leg corresponds to the left leg and the back leg to the right leg for a right-handed player.
2. The side of the court on which the contact point occurred: deuce side (DS), ad side (AS)
3. The direction of the incoming and outgoing ball: cross-court to cross-court (cc), down-the-line to down-the-line (ll), cross-court to down-the-line (cl), down-the-line to cross-court (lc)
4. The effectiveness of the shot: winner, generate error, continue, error.

Procedure

Data were collected by systematically observing the movement (type and direction) of both legs during the 3 phases of the shot (preparation, acceleration, and follow-through). The analysis was carried out by two observers, certified tennis coaches, specifically trained for this task. Inter-observer reliability was assessed with the Multirater Kappa Free (Randolph, 2005), reaching a very high degree of agreement (Kappa > 0.80).

Statistical analysis

The distribution of the different footwork patterns was expressed as a percentage of the total number of shots analyzed.

RESULTS

The analysis revealed 6 main footwork patterns.

Their distribution and effectiveness are shown in figure 1.

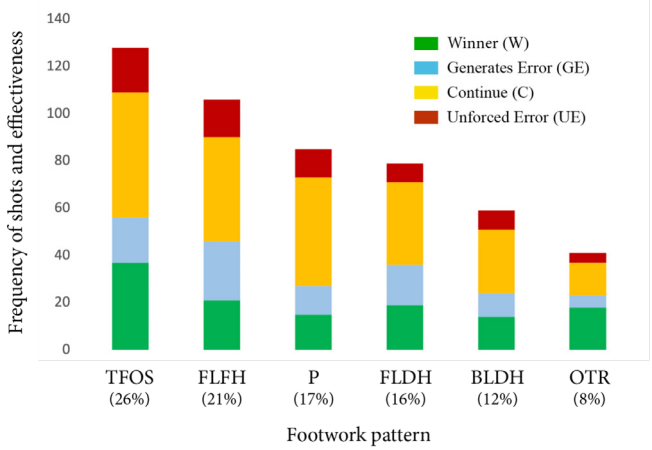

Figure 1. *Distribution of the 6 footwork patterns and their effectiveness.*

Abbreviations: TFOS, Transfer From semi or Open Stance; FLFH, Front Leg Forward Hop; P, Pivot; FLDH, Front Leg Diagonal Hop; BLDH, Back Leg Diagonal Hop; OTR, On The Run.

Figure 2 represents the contact point assuming that the players are right-handed (therefore, for the left-handed player analyzed in this study, the zone has been reversed) and the direction of the incoming and outgoing ball in the different footwork patterns.

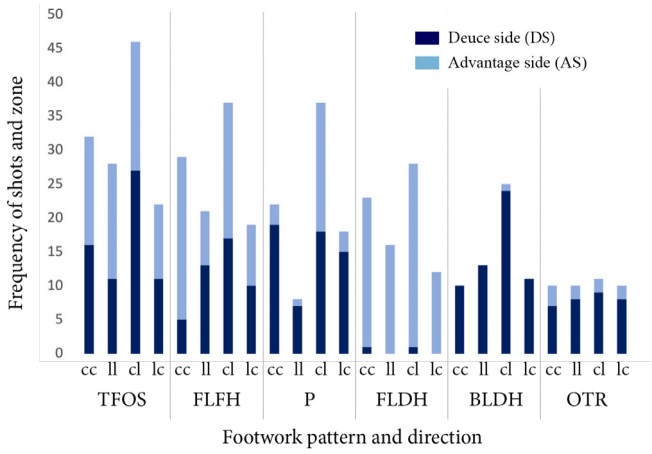

Figure 2. *Distribution of the 6 footwork patterns with its associated direction of the incoming and outgoing ball, and zone of contact.*

It has been observed that players, assuming they are all right-handed, play 52% of their forehands from the deuce side and 48%, from the advantage side. As for the direction of the outgoing ball, 60% of the strokes are down-the-line and 40% are cross-court. Players change direction in 55% of the cases, while they play to the same side than the incoming ball in 45% of the cases. On the deuce side two main footwork patterns are used, BLDH and OTR. On the other hand, FLDH is mainly used on the advantage side. The rest of the footwork patterns are executed on the deuce side or on the advantage side.

Definition of the footwork patterns

1. Front leg on the ground at contact

Figure 3 represents the 3 footwork patterns in which the front leg is on the ground when impact occurs between the racket and the ball.

I. Front leg forward hop (FLFH)

The player usually adopts a square position. The body weight is mainly on the front leg at the moment of contact. After contact, the player lifts off the ground forward and lands on the front leg.

II. Pivot (P)

The player usually adopts a square or semi-open position. The body weight is mainly on the front leg at contact. After contact, the back leg is brought to the side while the front leg pivots to initiate the recovery.

III. Front leg diagonal hop (FLDH)

This pattern is mainly used to run around the backhand to hit a forehand. The body weight is mainly on the front leg at contact. After contact the player lifts off the ground diagonally and lands on the front leg.

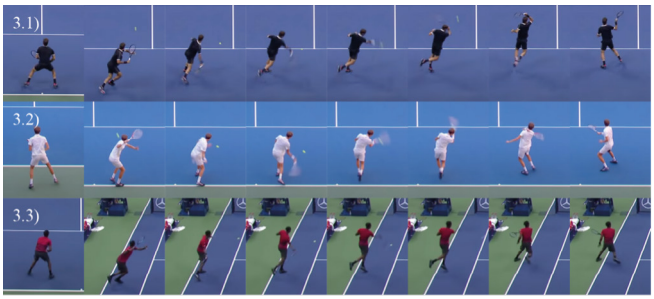

Figure 3. *3.1) FLFH, 3.2) P, 4.3) FLDH. Click on the image to see videos of footwork patterns.*

2. Front leg on air at contact

Figure 4 represents the 3 footwork patterns in which the front leg is in the air at impact between the racket and the ball.

IV. Transfer from semi or open stance (TFOS)

The player starts in an open or semi-open position, with the body weight mainly on the back leg. At contact, the player is in the air with a forward body transfer. After contact, the player lands on the front leg and the back leg is brought to the side to initiate the recovery. The player then moves the back leg to balance and begin repositioning.

V. Back leg diagonal hop (BLDH)

The player starts in an open or semi-open stance with the body weight mainly on the back leg. At contact, the body weight is transferred diagonally with the front leg in the air and carried in front of the body to maintain balance. After contact, the player lands on the back leg first and the front leg makes contact with the ground to initiate recovery.

VI. On the run (OTR)

The player hits the ball while running. Impact with the ball takes place between the ground contact of the back and the front leg, in a stride, without stopping.

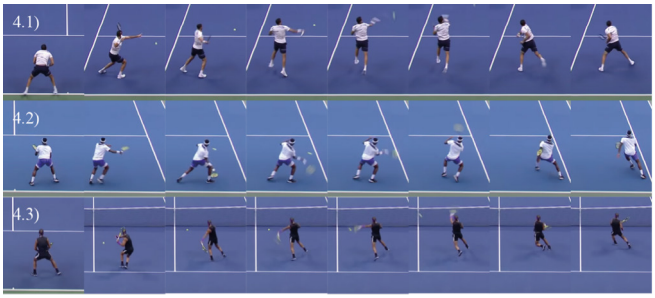

Figure 4. *4.1) TFOS, 4.2) BLDH, 4.3) OTR.. Click on the image to see videos of footwork patterns.*

DISCUSSION

This study highlights the variability of the movement actions for hitting an attacking forehand at elite level. To the best of our knowledge, this is the first time this work has been carried out and, therefore, it does not allow us to compare our results with those of the scientific literature.

In the 6 main patterns analysed, the back leg and the front leg have differentiated roles. The back leg is propulsive and the front leg is stabilising. The differences between the 6 patterns lie in the contact or non-contact with the ground of the front leg at impact and in propulsive orientation of the back leg. Horizontal ground reaction forces have been shown to have the greatest influence on ball velocity (Shimokawa et al., 2020). From a practical point of view, a more intense leg drive could increase the generation of racket head speed through increased angular velocity of the pelvis and trunk (Landlinger et al., 2010; Seeley et al., 2011).

Players play a similar amount of attacking forehands on the deuce side and on the advantage side. This may be because they can be more aggressive with this stroke than with the backhand on the advantage side. Also, they play a similar distribution of shots to the same side than changing direction, perhaps because on some occasions they want to play into empty space while on others they decide to play wrong-foot looking to take advantage in both cases.

PRACTICAL APPLICATION

A better understanding of the dynamics of footwork during the strokes allows coaches to give more adapted technical indications, but also to propose oriented physical exercises that should improve the efficiency of the kinetic chain (Genevois et al., 2016). Among these exercises, medicine ball throws occupy an important place and should be accompanied by ball strikes using the same footwork patterns to accentuate the transfer.

CONCLUSIONS

All types of footwork techniques can be defined as “transfer movements” with variations depending on the direction and intensity of propulsion and the way the body is stabilised. It is recommended that players, from an early age, learn to move effectively around the court to hit any type of ball correctly. The tennis coach and physical trainer should work together to ensure that players move correctly.

CONFLICT OF INTEREST AND FUNDING

The authors declare that they do not have any conflict of interest and that they did not receive any funding to conduct the research.

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