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## **GRF OF TABLE TENNIS PLAYERS WHEN USING LOOP DRIVE TECHNIQUE**

### **Abstract**

*In order to discover the characteristics of the GRF (Ground Reaction Force) during the loop drive techniques of table tennis, and to find the difference between two types of force to drive (medium strength and the maximal strength), the GRF of table tennis player was tested. The subjects were 10 excellent ping-pong players in China (20±2 years old, the training years were 11±2). Two groups of loop drive techniques were tested, using the measurement methods of the KISTLER force-plate system (two force-plates were used). The two groups of GRF data (peak and valley value of the vertical direction, left-right direction and the front-back direction) were analyzed and compared. The table tennis player's drive technique characteristic in three dimensions was described by the obtained dynamic data.*

*When compared the peak of left foot between two types of forcing method, the difference was evident. When the player drive loop with the maximal strength, it paid more attention to increase the GRF of left-right direction and front-back direction, which mean that the moving of gravity in left- right direction and front-back direction should be increased.*

**Key words:** *GRF, loop drive, strength, difference*

### **1 Introduction**

In order to discover the characteristics of the GRF (Ground Reaction Force) during the loop drive techniques of table tennis, and to find the difference between two types of force to drive (medium strength and the maximal strength) the GRF of table tennis player was tested. Furthermore, the authors hoped to give some suggestions for players and coaches on how to loop drive ping pong with the maximal strength.

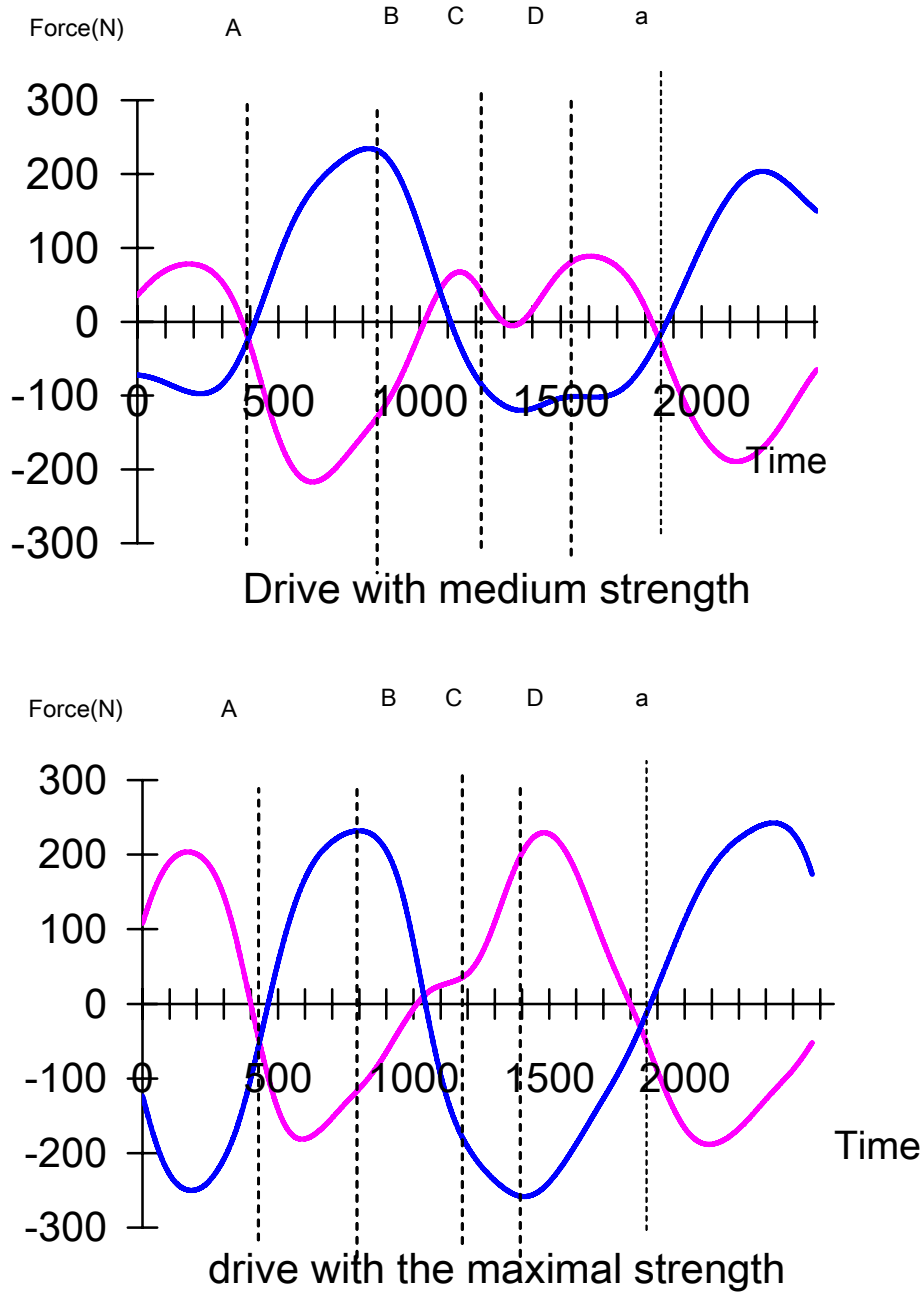
### **2 Material and Methods**

The participants were 10 excellent ping-pong players in China (20±2 years old, the training years were 11±2). Two groups of loop drive techniques were tested, using the measurement methods of the KISTLER force-plate system (two force-plates were used). One group of loop drive technique used medium strength, and the other used the maximal strength. The two groups of GRF data (peak and valley value of the vertical direction, left-right direction and the front-back direction) were analyzed and compared. The data of GRF subtracted the body weight.

### 3 Results and Discussion

#### 3.1 The analysis on the GRF in the vertical direction

Figure 1 GRF in the vertical direction



— Fz-left  
 — Fz-right

Note:

(1) Fz-left is the GRF of left foot, Fz-right is the GRF of the right foot.

(2) The definition of the character moment. The point of A is the beginning moment of the driving. The point of B is the ending moment of shaking racket backward. The point of C is the moment of batting the ball. The point of D is the ending moment of shaking racket forward. The point of a is the next beginning moment of the driving.

(3) The definition about the above in the other figures are same as thee picture 1.

Table 1: The comparison of the GRF in the vertical direction between left foot and right foot (n=10) unit: N

The peak value	Driving with the medium strength (M±SD)	Driving with the maximal strength (M±SD)
Right foot	220.57±14.78	226.67±19.55
Left foot	103.39±18.30*	207.97±27.20

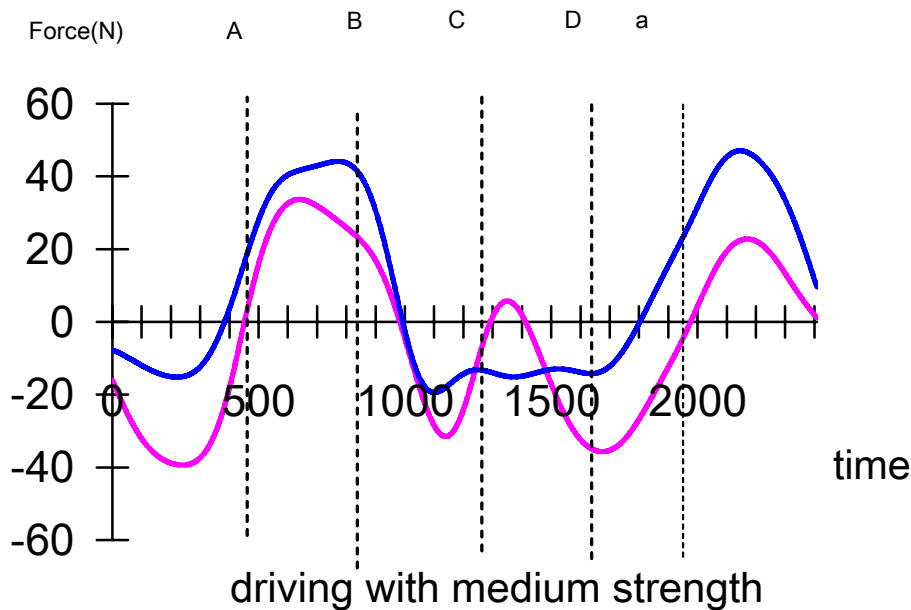
Note: \*, which represents the difference is significant between the driving with medium strength and maximal strength.

In the vertical direction of GRF, the maximal value of right foot when player used medium strength to drive loop was 220.57±14.78N, and the peak of using the maximal strength was 226.67±19.55N, which showed that the difference was no evident.

When compared the peak of left foot between two types of forcing method, the difference was evident. The peak value of the maximal strength (207.97±27.20N) was higher than the medium strength (103.39±18.30 N). The point of peak value of left was appeared at the end of the player’s driving when the gravity of player was moved from right foot to left foot fully. It can be explained that driving loop technique with maximal strength moved more.

### 3.2 The analysis on the GRF in the right-left direction

Figure 2 GRF in the left-right direction



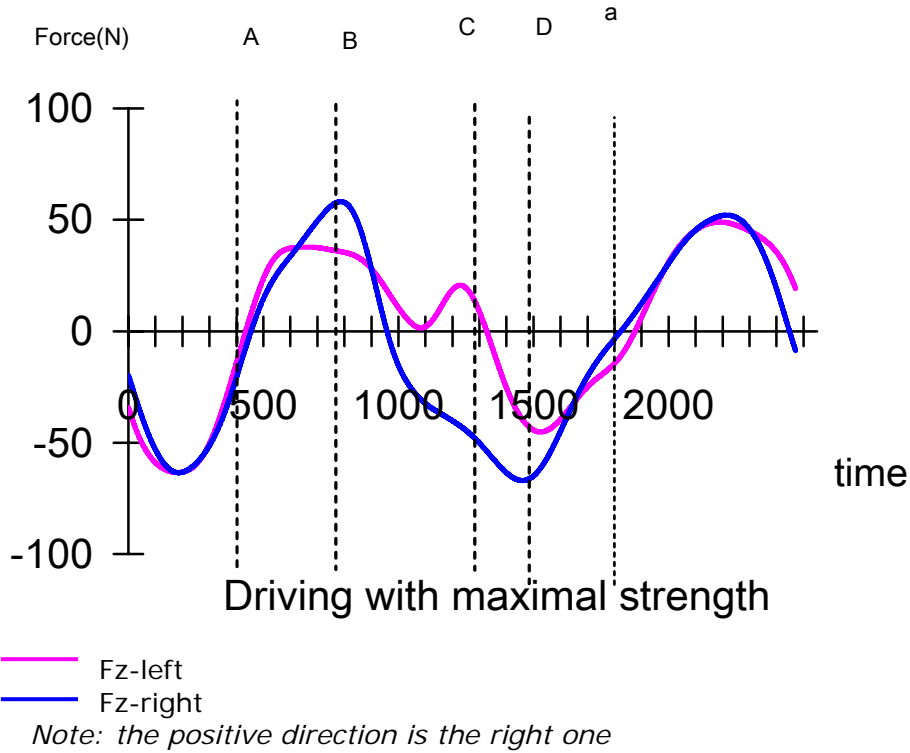


Table 2: The comparison of the GRF in the left-right direction between left foot and right foot (n=10) unit: N

value	foot	Driving with the medium strength (M±SD)	Driving with the maximal strength (M±SD)
The peak value	Right	42.77±6.11*	63.78±7.56
	Left	36.76±3.32*	41.54±5.70
The valley value	Right	- 15.12±3.54*	- 41.77±3.56
	Left	- 38.35±4.19*	- 63.59±7.23

Note: \*, which represents the difference is significant between the driving with medium strength and maximal strength.

In the left-right direction of GRF, both the peak and valley values of right foot and left foot were compared, there was evident difference between two types of force, and the driving with maximal strength was higher. The peak values of right foot of two type of force were 63.78±7.56 N and 42.77±6.11 N. The peak values of left foot of two type of force were 41.54±5.70 N and 36.76±3.32 N. The valley values of right foot of two type of force were -41.77±3.56 N and -15.12±3.54 N. The valley values of left foot of two type of force were -63.59±7.23 N and -38.35±4.19 N.

### 3.3 The analysis on the GRF in the front-back direction

Figure 3 GRF in the front-back direction

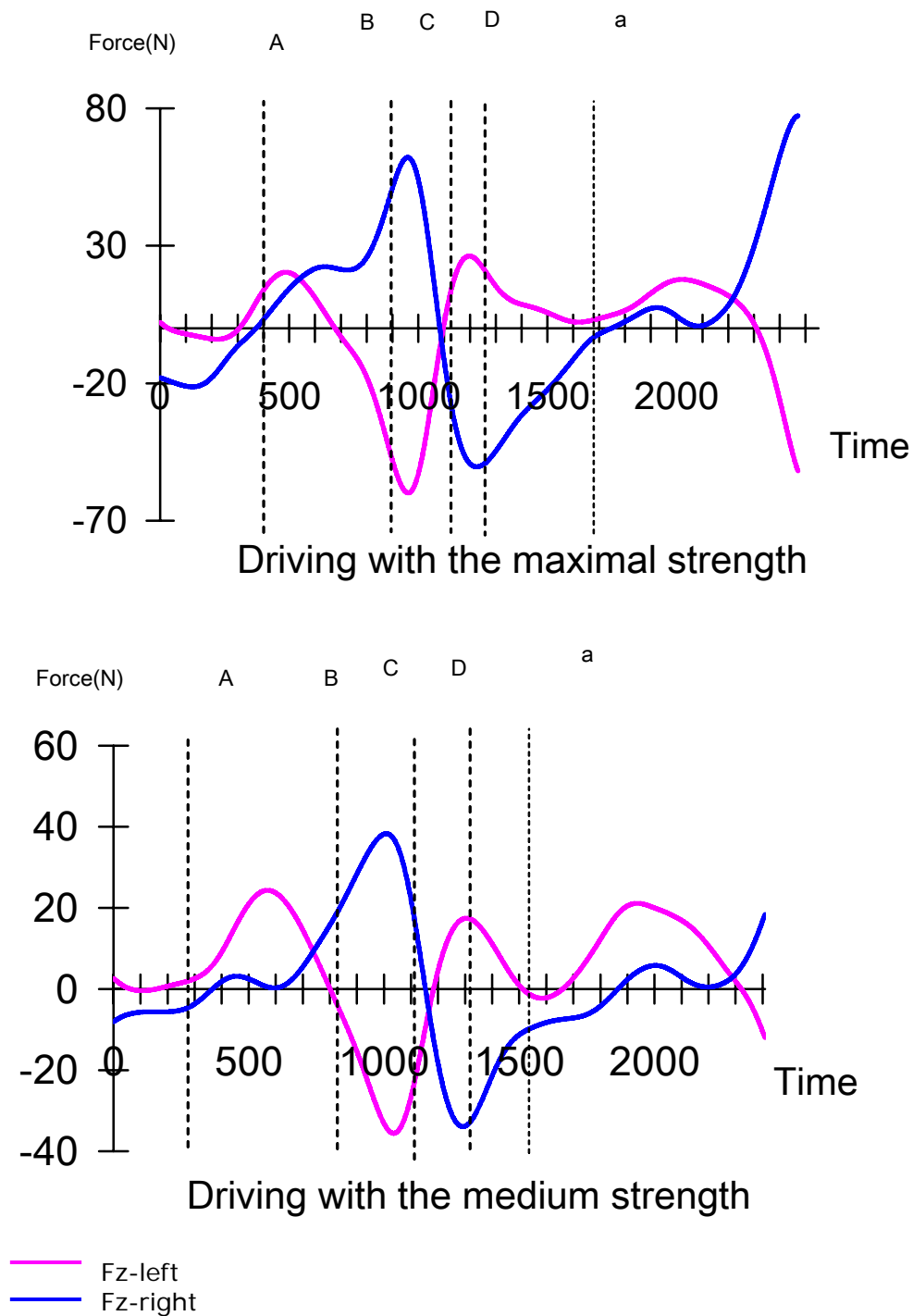


Table 3 the comparison the GRF in the front-back direction between left foot and right foot (n=10) unit: N

value	Driving with the medium strength (M±SD)	Driving with the maximal strength (M±SD)
The peak value of right foot	32.38±3.49*	59.89±7.05
The valley value of right foot	- 38.13±5.87*	- 63.54±7.90
The peak value of left foot	12.89±2.08*	23.11±2.46
The valley value of left foot	- 38.56±4.02*	- 61.09±4.76

Note: \*, which represents the difference is significant between the driving with medium strength and maximal strength.

In front-back direction, the peak and valley values of right foot and left foot were compared, there was evident difference between two types of force, and the driving with maximal strength was higher.

### 3 Conclusions

The table tennis player's drive technique characteristic in three dimensions was described by the obtained dynamic data.

When the player drive loop with the maximal strength, it paid more attention to increase the GRF of left-right direction and front-back direction, which mean that the moving of gravity in left- right direction and front-back direction should be increased.

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