Experimental Study of the Larger Ball's Effect on the Shock Vibrations at the Wrist joint during the ground stroke and at the Elbow Joint during the Service Stroke

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Outline of the Test

In the ground stroke test, accelerations at the player's wrist joint and the racket handle were measured. In the service stroke test, accelerations at the player's elbow joint and the racket handle were measured. The location of accelerometer at the racket handle is 210 mm from grip end.

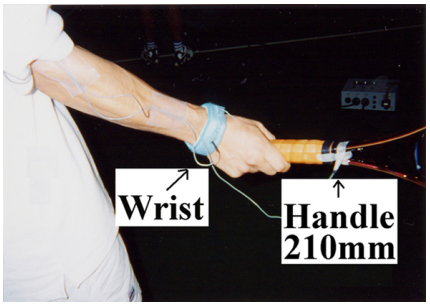
In the ground stroke the wave forms of the off-center (Top) hitting and the center hitting were recorded, while in the service stroke only those of the center hitting were recorded.

Although we tested 3 types of balls, we report the comparison between the larger ball and the conventional normal ball.

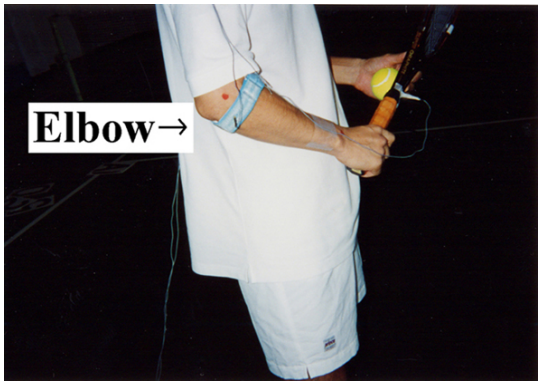
Two rackets (Prince SG) were used in this test, and each racket was strung at 45 lbs and 65 lbs. The mass of strung racket was 338[g], total length 685[mm], and the balance (center of gravity from grip end) was 327[mm].

The following photographs show the situation of the test. Five trials are recorded per each test condition.

Situation of hitting test



Location of accelerometers at the wrist joint and the racket handle in the forehand ground stroke.



Location of accelerometers at the elbow joint and the racket handle in the service stroke.

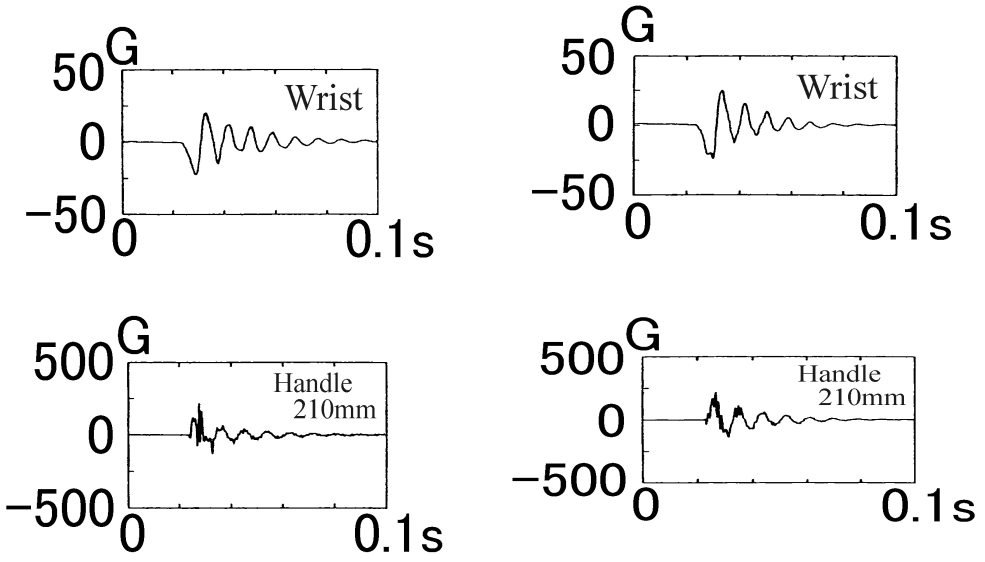
Type 3 Type 2 Type 1

Three types of balls

Figure 1 and Fig.2 shows the measured accelerations at the player's wrist and the racket handle when a male tournament player hits flat forehand drive. The racket is strung at 45 lbs.

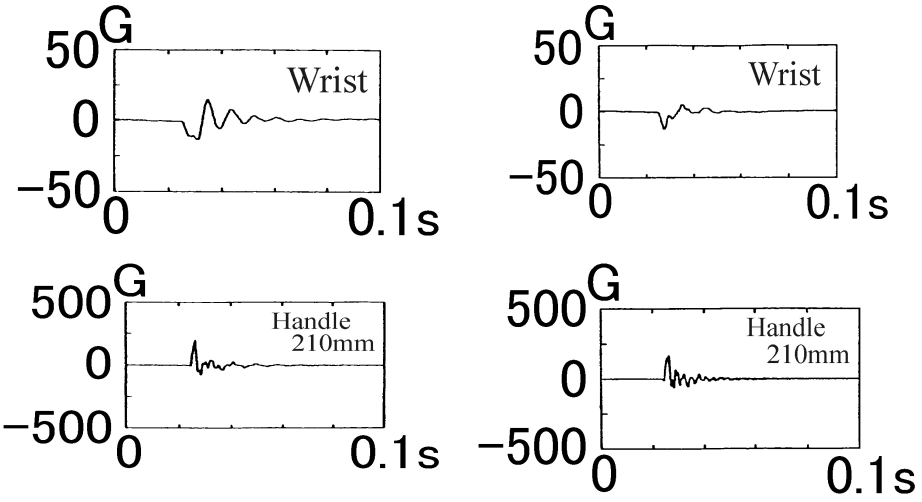
Figure 1 shows comparison between the normal ball and the larger ball with the measured shock vibrations at the wrist and the racket handle 210 mm from the grip end when hitting at the off-center (Top) of the racket face. The racket is strung at 45 lbs. Figure 2 shows comparison between the normal ball and the larger ball with the measured shock vibrations at the wrist and the racket handle 210 mm from the grip end when hitting at the center of the racket face. The racket is strung at 45 lbs.

The waveforms of the normal ball and larger ball are very similar.



(a) Normal ball **(b) Larger Ball**

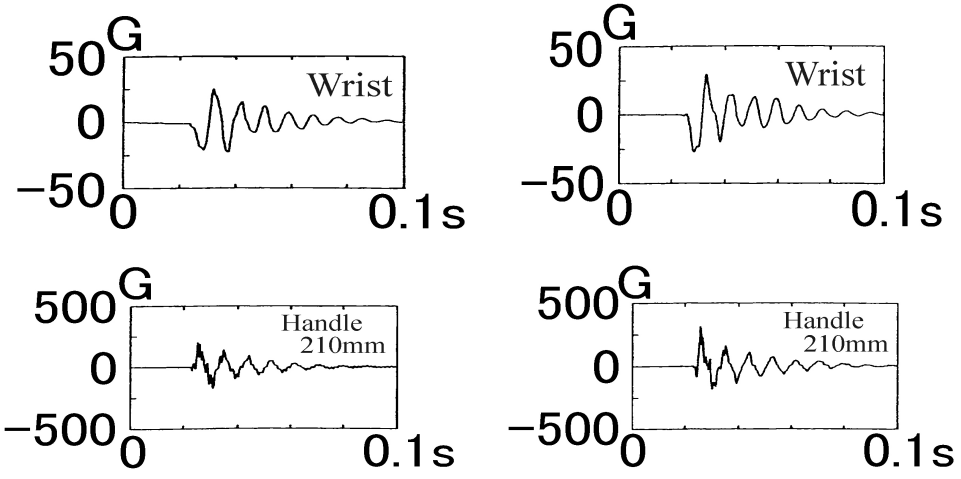
Fig.1 Measured shock vibrations at the wrist and the racket handle (210 mm from grip end) when hitting at the off-center (Top) of racket face. The racket is strung at 45 lbs.



(a) Normal ball **(b) Larger ball**

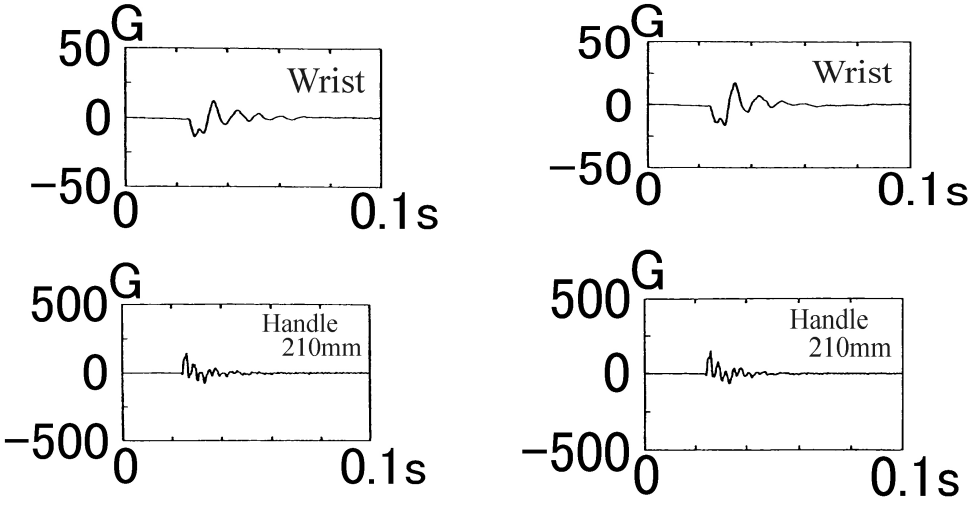
Fig.2 Measured shock vibrations at the wrist and the racket handle (210 mm from grip end) when hitting at the center of racket face. The racket is strung at 45 lbs.

Figure 3 and Fig.4 shows when the racket is strung at 65 lbs.
Figure 3 shows comparison between the normal ball and the larger ball with the measured shock vibrations at the wrist and the racket handle 210 mm from the grip end when hitting at the off-center (Top) of the racket face. The racket is strung at 65 lbs.
Figure 4 shows comparison between the normal ball and the larger ball with the measured shock vibrations at the wrist and the racket handle 210 mm from the grip end when hitting at the center of the racket face. The racket is strung at 65 lbs.
The waveforms of the normal ball and larger ball are very similar.



(a) Normal Ball **(b) Larger Ball**

Fig.3 Measured shock vibrations at the wrist and the racket handle (210 mm from grip end) when hitting at the off-center (Top) of racket face. The racket is strung at 65 lbs.



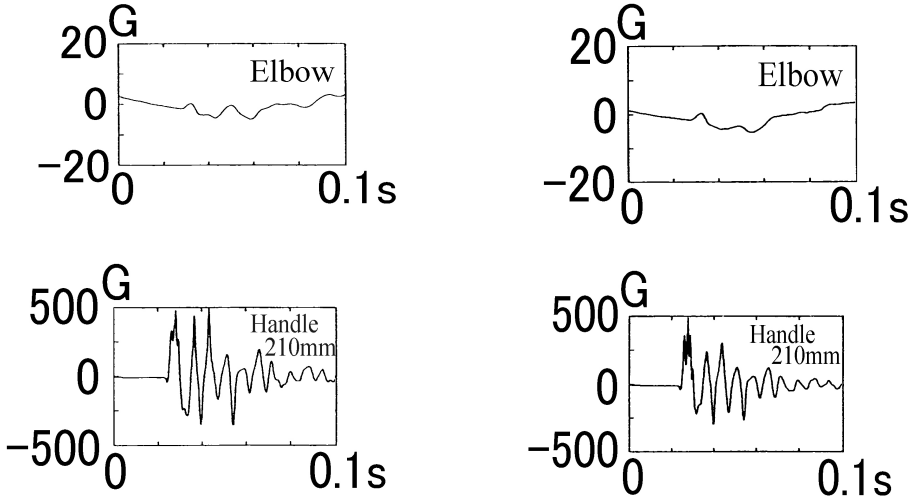
(a) Normal ball **(b) Larger ball**

Fig.4 Measured shock vibrations at the wrist and the racket handle (210 mm from grip end) when hitting at the center of racket face. The racket is strung at 65 lbs.

Figure 5 and Fig.6 shows the measured accelerations at the player's elbow joint and the racket handle when a male tournament player hits service at the center of the racket face.

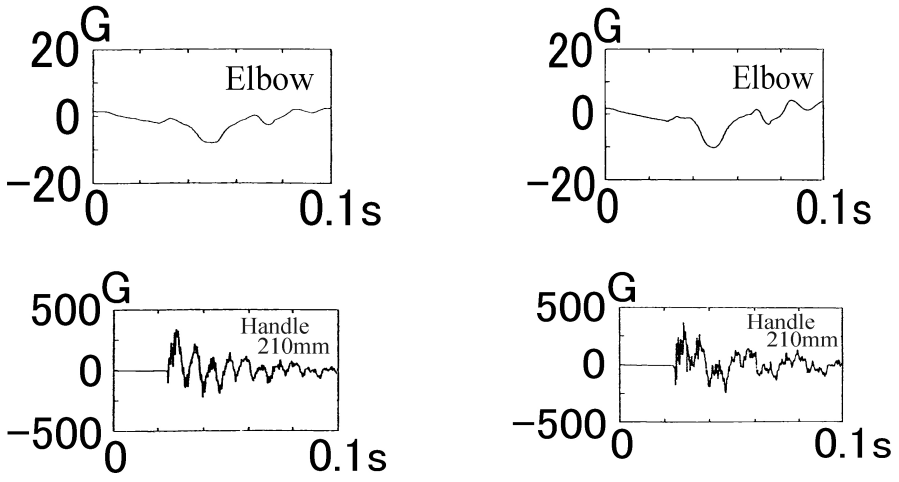
Figure 5 shows comparison between the normal ball and the larger ball with the measured shock vibrations at the elbow joint and the racket handle 210 mm from the grip end when hitting service at the center of the racket face. The racket is strung at 45 lbs. Figure 6 shows comparison between the normal ball and the larger ball when the racket is strung at 65 lbs.

The waveforms of the normal ball and larger ball are very similar.



(a) Normal Ball **(b) Larger Ball**

Fig.5 Measured shock vibrations at the elbow joint and the racket handle (210 mm from grip end) when hitting service at the center of racket face. The racket is strung at 45 lbs.



(a) Normal Ball **(b) Larger Ball**

Fig.6 Measured shock vibrations at the elbow joint and the racket handle (210 mm from grip end) when hitting service at the center of racket face. The racket is strung at 65 lbs.