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INFLUENCE OF GLUE ON BALL SPEED
(Comparison between speed glue and aqueous glue)

Abstract

The purpose of the present study is to clarify the difference in ball speed due to different glue. Many players, particularly offensive players, prefer the speed glue.

Ball speed was measured in the actual play where players hit the ball practically. Data were processed by statistical treatment. The present report describes the results obtained nearly one year ago. One year ago, aqueous glue was quite limited to only a few kinds. As long as we see the results of one year ago, it is shown that ball speed is in general higher in the case of speed glue than aqueous glue. Now the number of aqueous glue is increasing and many efforts are being made to improve the elasticity. It is expected that aqueous glue with no significant difference from speed glue is available.

Key words: *table tennis, glue, organic solvent, aqueous glue, ball speed*

1. Introduction

Increasing ball speed is a great concern for table tennis players. For increasing the ball speed, manufacturers have been making various efforts to make sponge rubber more elastic. The elasticity of rubber depends not only on the materials of rubber itself, but also on how to bond the rubber with the blade which is usually made of wood or plywood. It is well known that organic solvent contained in some glue makes sponge rubber swell because solvent volatilizes in the sponge for a few hours after bonding (1),(2). As a result, sponge rubber becomes more elastic. This kind of glue is called “speed glue”. Unfortunately, such organic solvent is toxic more or less. Therefore, the influence of organic solvent on players’ health has been a big issue in the table tennis world. ITTF BOD decided in 2004 that the speed glue with organic solvent should be prohibited from September 1, 2007. However, this decision was modified and the date of starting prohibition was extended to September 1, 2008.

Responding to these decisions, some Japanese manufacturers have developed aqueous glue without using organic solvent. Some of the aqueous glue are authorized by JTTA and already sold in shops. The aqueous glue developed so far does not have any swelling effect on sponge rubber.

Under the circumstances mentioned above, player and coaches are anxious about the influence of glue regulation on play. JTTA SMSC (JTTA Sports and Medical Science Committee) has organized a project team in June, 2005. The aim of this study is to clarify the influence of glue on ball speed. Particular interest is comparison between speed glue and aqueous glue.

It is expected that if players are forced to use the aqueous glue, they will use it combined with a booster. The booster is a harmless chemical which has the swelling effect on the sponge rubber. In this study, the effect of the booster on speed was also investigated by applying the booster to aqueous glue and glue sheet.

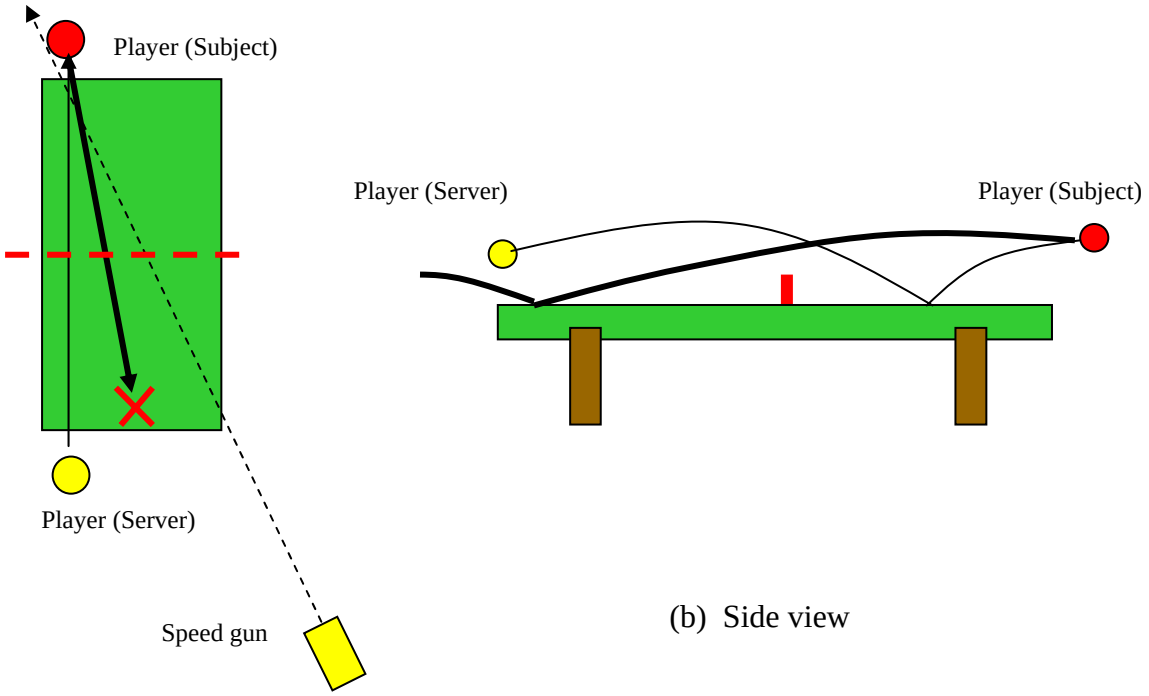
2. Method

The test took place in the gymnasium of Waseda University on February 15th, 2006. The subjects in the test were 4 male students of the university team. All of them are top

student players in Japan. We made each player use the same kinds of blade and rubber as he uses usually in the match. Table 1 shows blades and rubbers used by them.

The following 5 kinds of glue were tested: (1) Speed glue (A, B and C), (2) Aqueous glue (A, B and C) and (3) Glue sheet

In the test of aqueous glue, measurements were made for both cases with and without booster. The booster was always used for the test of the glue sheet. To avoid mixing of different glues, the blade and rubber used for one case was replaced with new ones for another case.



(a) Top view

(b) Side view

Fig.1 Test set up

Table 1 Blades and rubbers

Player	Blade			Rubber		
	Maker	Model	Glip	Maker	Model	Thickness
M1	Butterfly	Primorac	CO	X	A	Large
M2	Butterfly	Korbel	CO	X	B	Large
M3	Nittaku	Ludeack	ST	Y	C	Large
				Y	D	Large
M4	Butterfly	Timo Boll Spirit	ST	Z	E	Large
				Z	F	Medium

Table 2 shows the combination of subjects and glue. The subjects were not informed which kinds of glue were used in the test blades. Another player served a ball with small top spin to the subject. The subject was ordered to strike the ball with full swing. The height of the ball at the point of the subject was so suitable that he was able to hit the ball satisfactorily. The speed of fed ball was 20 km/h. Under this ball speed, the subject can afford to strike the ball with full swing. Figure 1 shows the set up of the test. Stoke was limited to forehand in the test. Measurements were made for both drive and smash. Subjects M3 and M4 used the two kinds of rubber and thus measurement was made for each rubber.

Table 2 Test Glue

M1, M2	M3	M4
(1) Speed glue A	(1) Speed glue B	(1) Speed glue C
(2) Aqueous glue A	(2) Aqueous glue A	(2) Aqueous glue B
(3) Aqueous glue A with booster	(3) Glue sheet with booster	(3) Aqueous glue B with booster
(4) Aqueous glue C		
(5) Glue sheet with booster		

Aqueous glue A: JUIC Aqua Effect,
Aqueous glue B: TSP Water Glue,
Aqueous glue C: JUIC Aqua Stick
Glue sheet: JUIC Sheet,
Booster: JUIC Ecolo Expander II

The ball speed was measured by a speed gun (Applied Concept Inc., Stalker Pro). The measurable range of the speed gun is 1 to 480 km/h. Measurements under the same condition were repeated 30 times. Highest 5 and lowest 5 values were omitted from the 30 data. Average ball speed was obtained by averaging the remaining 20 data. Statistical treatment was applied to data processing for precise criteria whether difference is significant. The significance level p was assumed 0.0001. We collected comments of players immediately after the test of each case.

3. Results

Table 3 to 6 show numerical data of measured results.

Table 3 Ball speed (km/h) of Subject M1

Glue	Drive	Smash
	Average SD	Average SD
(1) Speed glue	81.8 ± 1.2	92.9 ± 1.9
(2) Aqueous glue A	78.4 ± 1.6	91.2 ± 1.3
(3) Aqueous glue A with booster	77.6 ± 1.7	90.9 ± 1.8
(4) Aqueous glue C	78.4 ± 1.1	90.9 ± 1.3
(5) Glue sheet with booster	78.2 ± 1.1	90.9 ± 1.3

SD: Standard deviation

Table 4 Ball speed (km/h) of Subject M2

Glue	Drive	Smash
	Average SD	Average SD
(1) Speed glue	76.8 ± 1.6	91.9 ± 1.4
(3) Aqueous glue A	71.5 ± 1.7	83.2 ± 1.9
(4) Aqueous glue A with booster	72.8 ± 0.8	86.4 ± 2.1
(5) Aqueous glue C	73.8 ± 1.0	84.1 ± 2.1
(5) Glue sheet with booster	73.4 ± 1.2	86.3 ± 2.6

SD: Standard deviation

Table 5 Ball speed (km/h) of Subject M3

Rubber		Drive	Smash
		Average SD	Average SD
C	(1) Speed glue	74.1 ± 1.7	91.1 ± 2.3
	(2) Aqueous glue A	69.2 ± 1.7	90.3 ± 1.4
	(3) Glue sheet with booster	71.7 ± 1.5	86.4 ± 2.2
D	(1) Speed glue	73.7 ± 1.5	87.2 ± 1.2
	(2) Aqueous glue A	71,2 ± 1.4	86.7 ± 1.5
	(3) Glue sheet with booster	73.4 ± 2.1	87.8 ± 1.2

SD: Standard deviation

Table 6 Ball speed (km/h) of Subject M4

Rubber		Drive	Smash
		Average SD	Average SD
E	(1) Speed glue	77.1 ± 1.3	89.9 ± 1.1
	(2) Aqueous glue B	77.2 ± 1.9	90.8 ± 1.9
	(3) Aqueous glue B with booster	72.9 ± 1.3	90.8 ± 0.7
F	(1) Speed glue	71.4 ± 1.6	91.1 ± 2.1
	(2) Aqueous glue B	68.1 ± 1.8	87.4 ± 1.5
	(3) Glue sheet with booster	69.9 ± 1.8	92.3 ± 1.9

SD: Standard deviation

Figs. 2 to 13 show graphs. As described above, the significance of these data are tested by using statistical theory. The asterisk mark "*" and the symbol "n.s" are shown in figure 2 to 12. The asterisk "*" means that the difference between two data can be admitted. This situation is described in technical terms of statistical theory that the difference is significant. The symbol "n.s" stands for "no significance" which means that the difference between two data can not be admitted statistically even if numerical data are different.

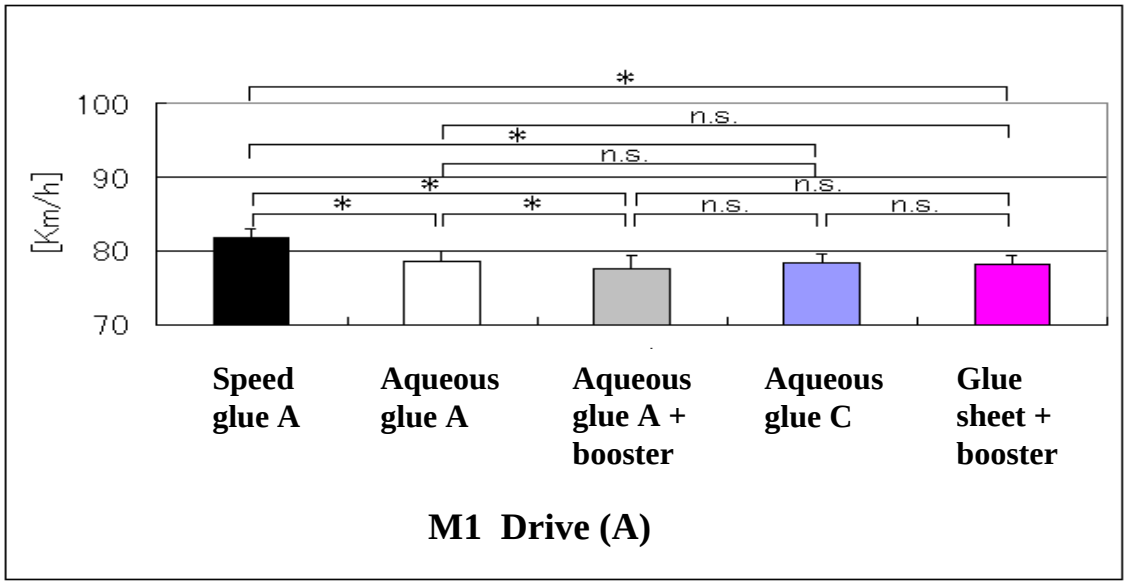


Fig. 2 Speed of drive ball struck by Subject M1

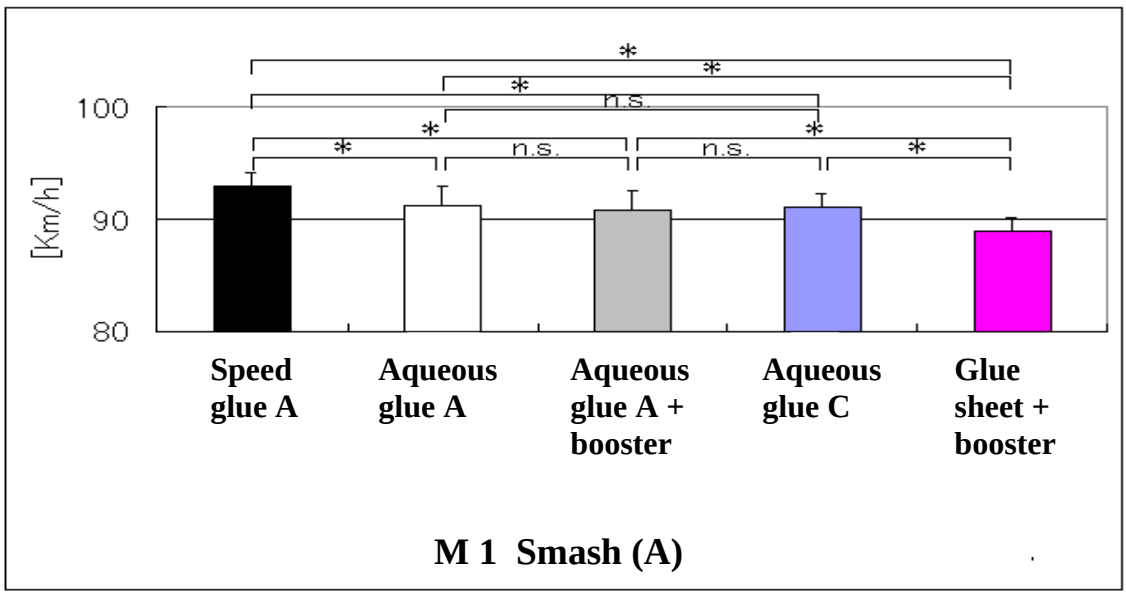


Fig. 3 Speed of smash ball struck by Subject M1

In the results of drive, the speed with Speed glue A is 4 to 5 % higher than all other data. It can be said that there is no difference in cases of three aqueous glues. In the results of smash, the difference between the speed with Speed glue A and speeds with other glues becomes less; The difference is about 2 %.

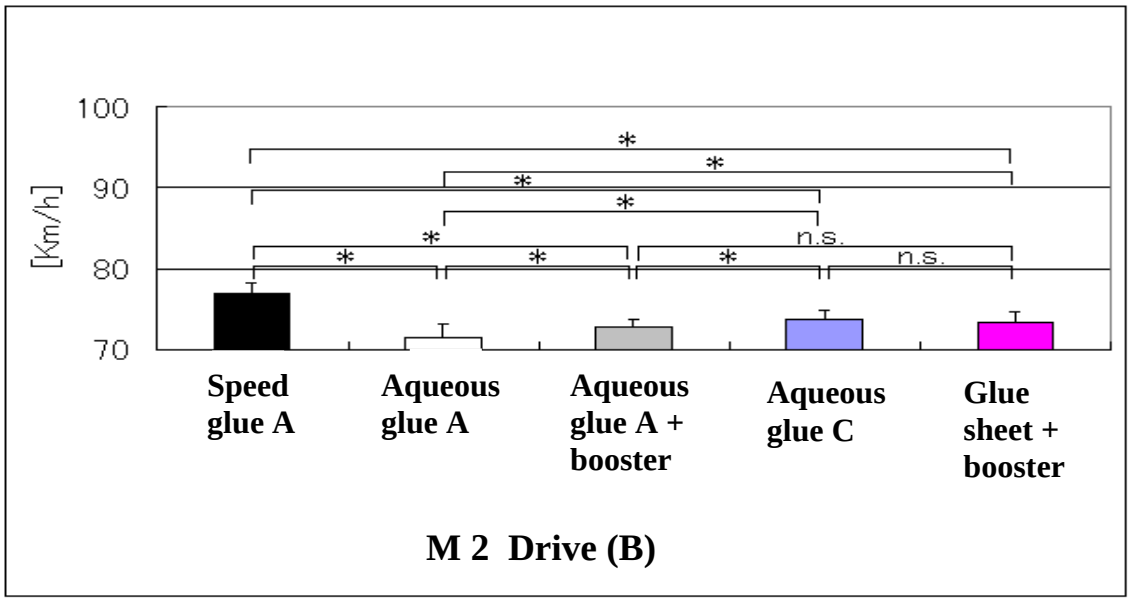


Fig. 4 Speed of drive ball struck by Subject M2

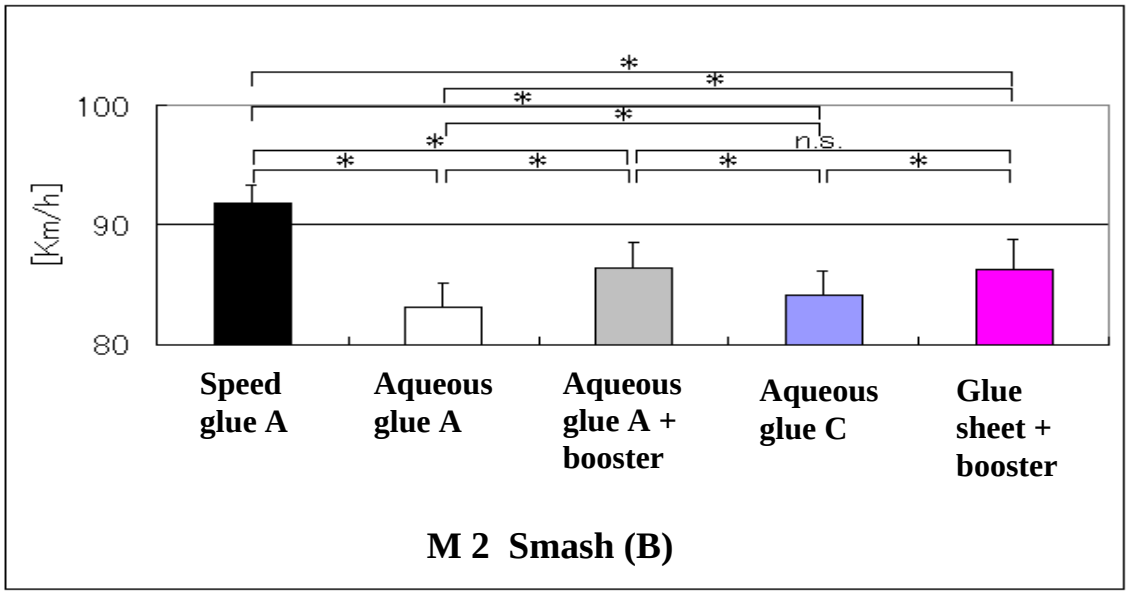


Fig. 5 Speed of smash ball struck by Subject M2

In the results of Subject M2, the difference between the case with Speed glue A and other cases is more remarkable. The speed with Aqueous glue A is remarkably lower than the speed with Speed glue A, but the effect of the booster is obvious for Aqueous glue A. That is, the 7 % difference in drive ball speed between Aqueous glue A and Speed glue A changes to 5% when the Aqueous glue A is combined with the booster. In the smash stroke, the difference changes from 9 % to 6 %.

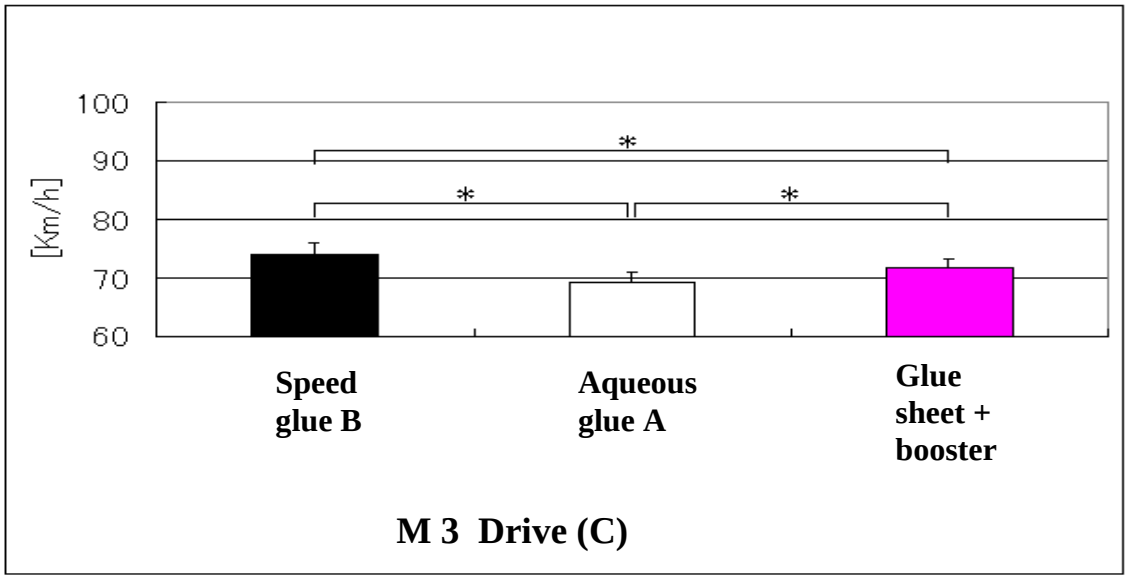


Fig. 6 Speed of drive ball struck by Subject M3

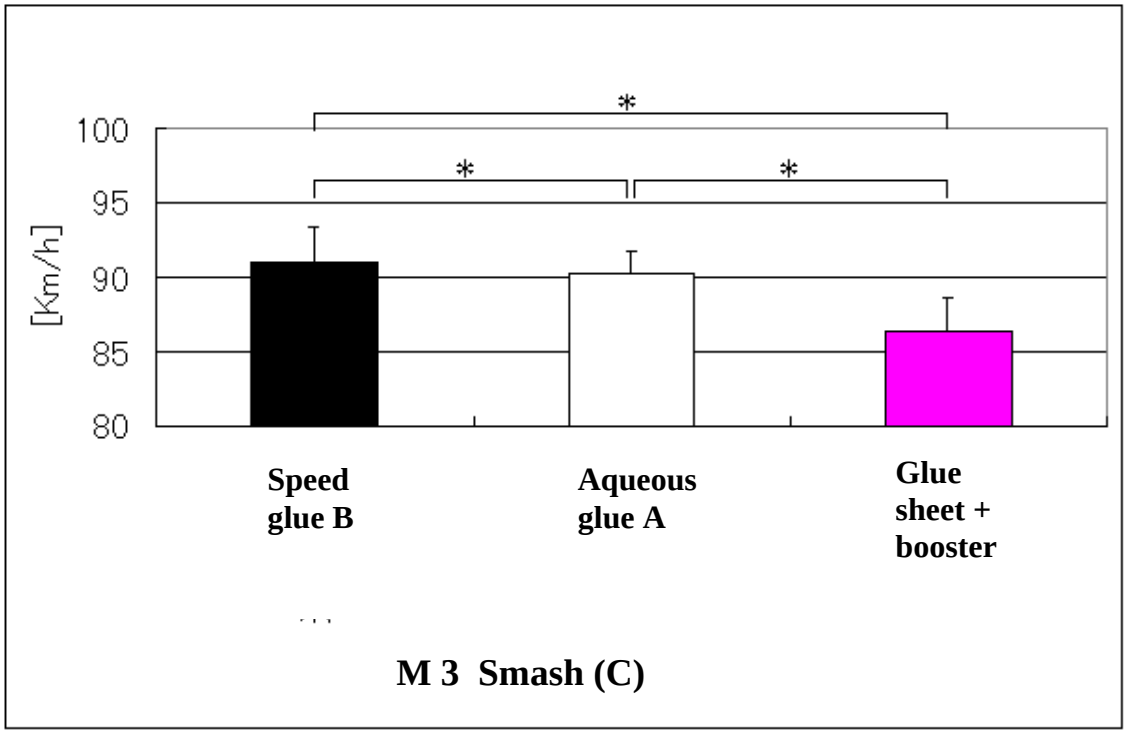


Fig. 7 Speed of smash ball struck by Subject M3

Figs. 6 and 7 show the results for the rubber "C". In the results of drive, the speed with Speed glue B is obviously high compared with other cases, but in the results of smash, the difference between the case of Speed glue B and the case of Aqueous glue A is quite small.

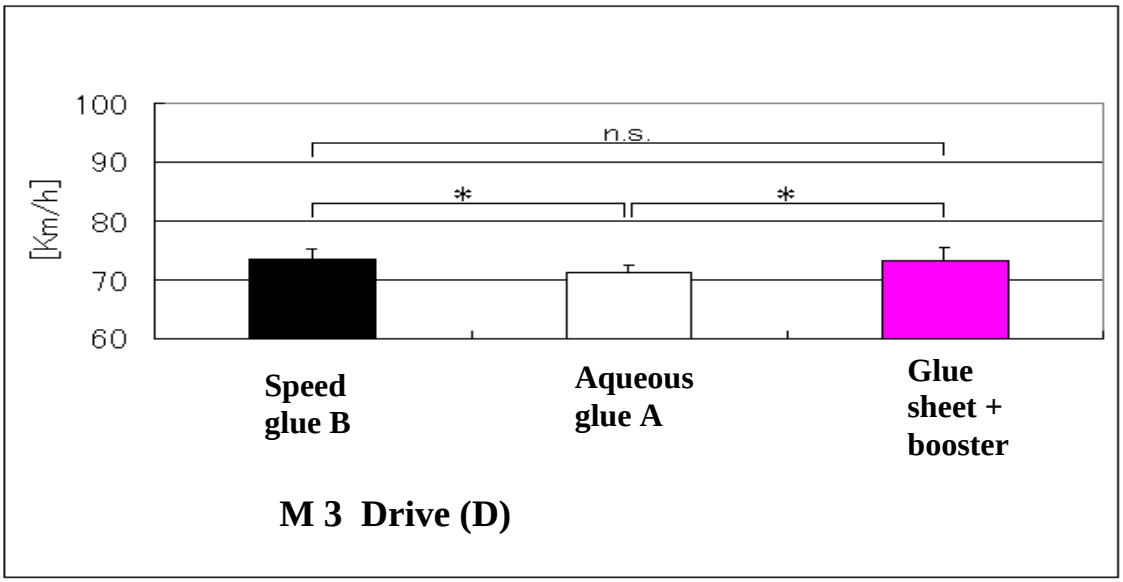


Fig. 8 Speed of drive ball struck by Subject M3

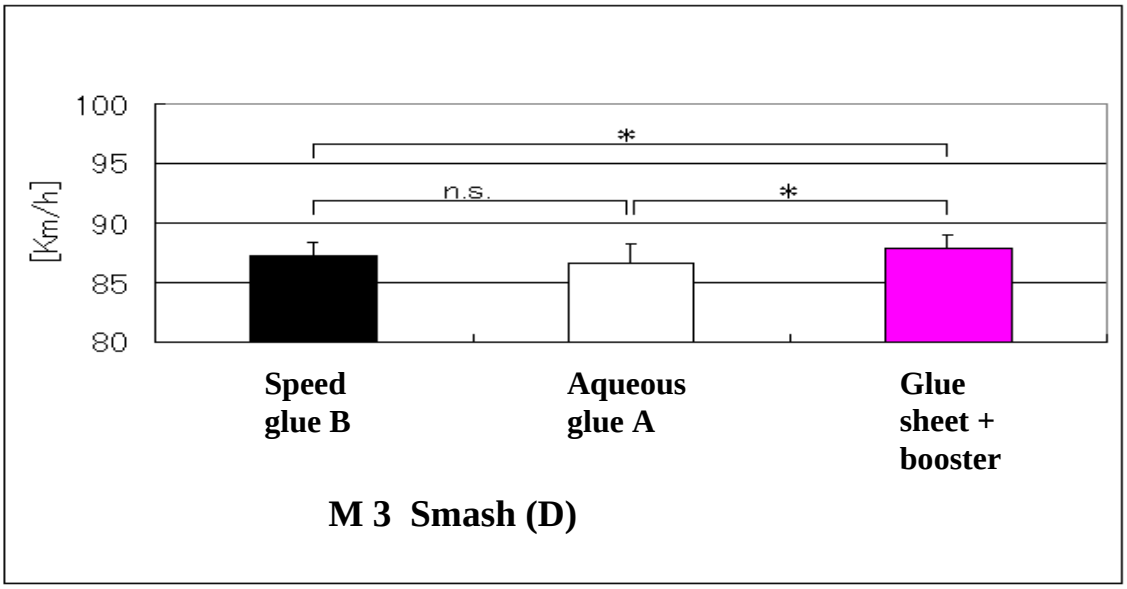


Fig. 9 Speed of smash ball struck by Subject M3

Figs. 8 and 9 show the results of Subject M3 using the rubber "D". The difference between the case of Speed glue B and Aqueous glue A is small. Statistically it can be said that there is no difference between both cases. The speed with Glue sheet + booster which is low or lowest in the test of other subjects is high in this test of subject M3.

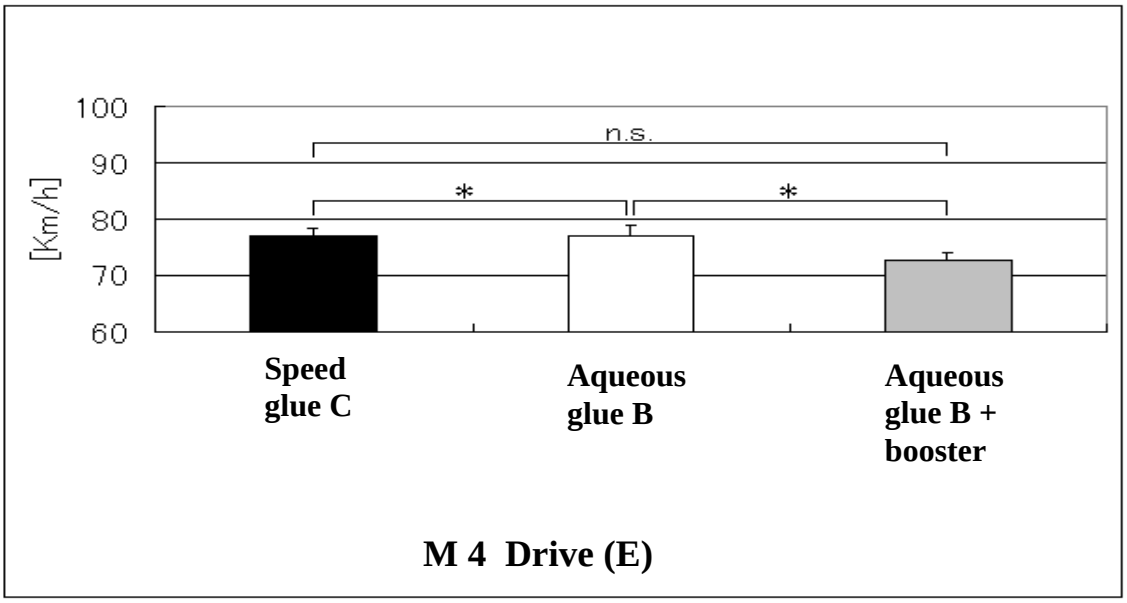


Fig. 10 Speed of drive ball struck by Subject M4

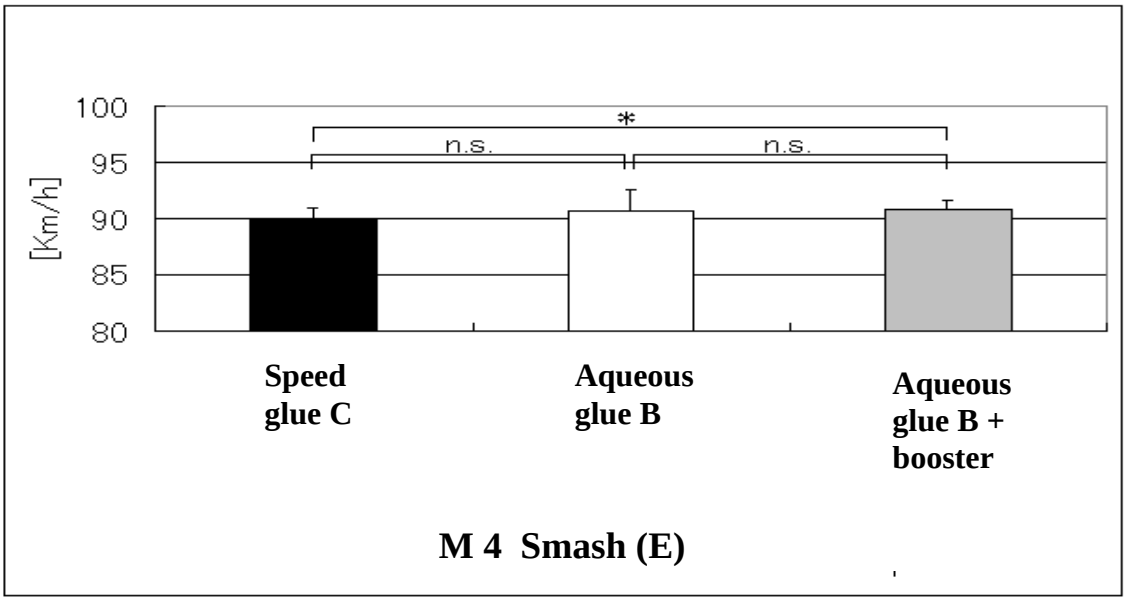


Fig. 11 Speed of smash ball struck by Subject M4

The results in Figs. 10 and 11 are unexpected with respect to two aspects. First, the speed with speed glue is not highest as shown in Fig. 11, but the aqueous glue gives higher speed. Second, the booster does not have the positive effect on ball speed as shown in Fig. 10. If these results are accepted as the truth, the Aqueous glue B is better than the Speed glue C and the booster is not effective for the Aqueous glue B. However, we must consider another possibility. That is, weariness of the subjects during the test may cause these results. The test lasted for a few hours and we found that players felt tired near the end of the test.

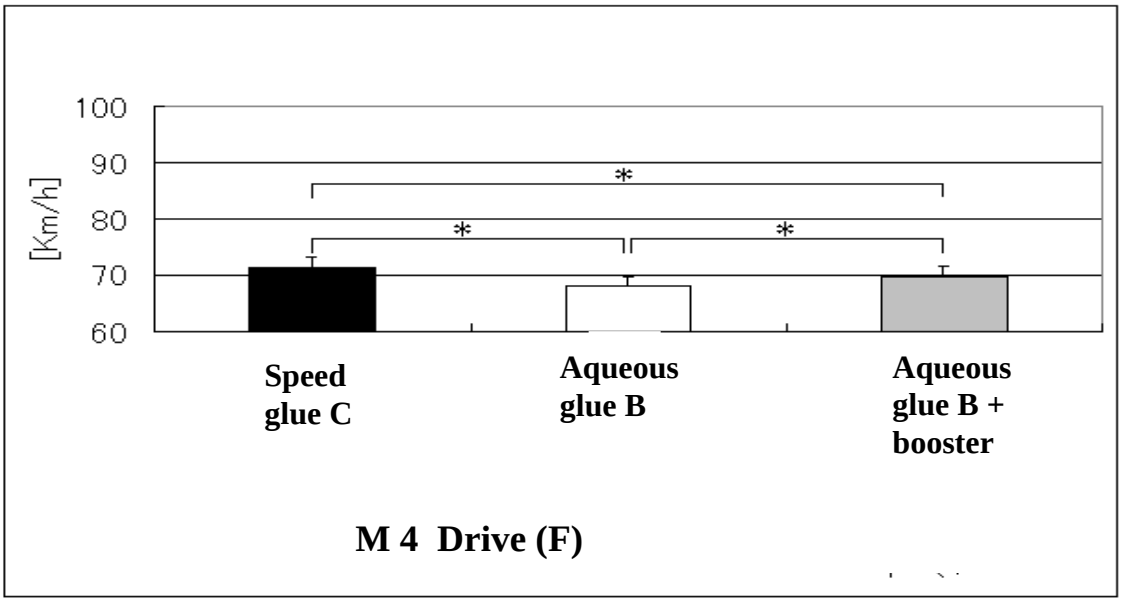


Fig. 12 Speed of smash ball struck by Subject M4

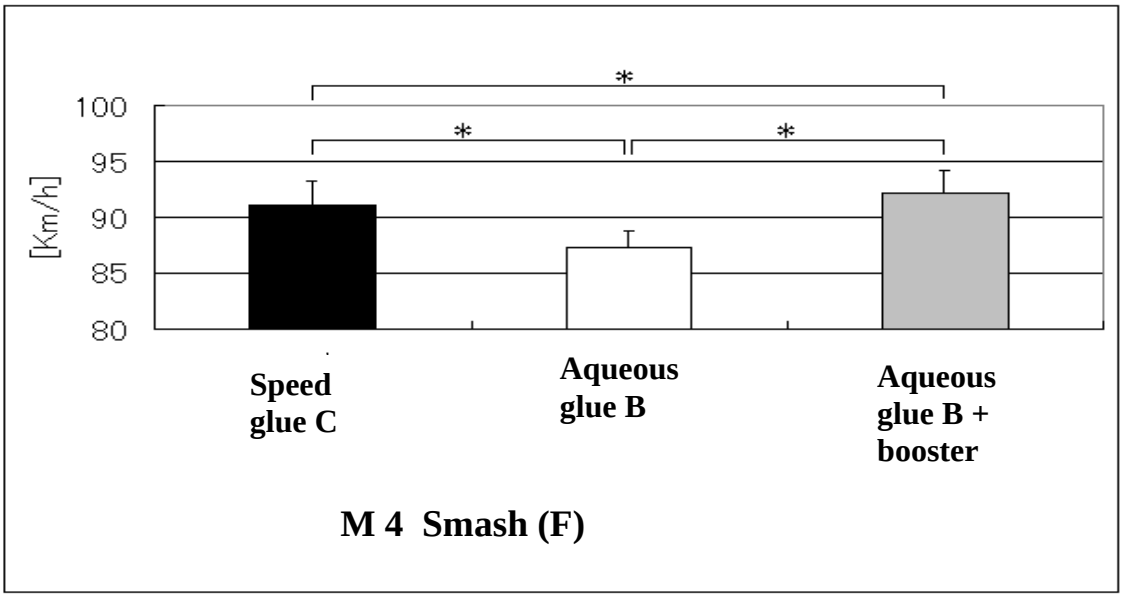


Fig. 13 Speed of smash ball struck by Subject M4

In the drive stroke, the result of Aqueous glue B + booster is almost the same as the result of Speed glue C. In the smash stroke, the speed with Aqueous glue B + booster is highest.

The players' comments concerning aqueous glue are as follows. In general, the subjects felt that the drive ball speed is lower in aqueous glue but the smash ball speed is not so much different between the speed glue and aqueous glue. These comments coincide with measured results. A subject had an ill feeling and another one had a good feeling for the aqueous glue. Most of them agreed that the aqueous glue is bearable.

Finally, it must be stated that the aqueous glue which was available one year ago was limited. Now several aqueous glues have been developed and sold. Many efforts are being made to improve the elasticity. We found through private communication that results of some new aqueous glue indicate no significant difference from those of speed glue.

Concluding remarks

The results are summarized as follows. In general, the ball speed with speed glue is higher than the speed with other kinds of glue in the drive stroke. The difference was at most 7%. However, in some cases, the difference is negligible or even the opposite tendency was observed; that is, the aqueous glue gave higher speed than the speed glue.

In general, the difference between the speed glue and aqueous glue is small or not obvious in the smash stroke compared with the drive stroke. Also in some smash strokes, the aqueous glue or glue sheet combined with the booster gave higher speed than the speed glue. Thus it can be said that the difference between the speed glue and other glues is delicate. That depends on the combination of rubbers and glues and also depends on players' weariness during the test. It is also found from comments of players that they did not have a strong negative feeling for the aqueous glue, particularly in the smash stroke.

Acknowledgement

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References

(1) Tiefenbacher, Konrad and Durey, Alain, The impact of the Table Tennis Ball on the Racket (Backside Coverings), International Journal oif Table Tennis Sciences No.2 (August 1994), ITTF, ISSN 0966-9256

(2) http://www.tomveatch.com/tt/speed.glue.patent.text.html