

Analysis of the Duration and Rest Time of Wheel Chair Para Table Tennis at the Rio 2016 Paralympic Games

Willian Gabriel Felício da Silva and Fábio Tadeu Reina

Department of Physical Education, University of the Araraquara (UNIARA), Araraquara-SP 1480134, Brazil

Abstract: The purpose of this study was to analyse and compare the match characteristics of wheelchair PTT (Para table tennis) classes that played in the team tournament at the Rio 2016 Paralympic. Eight PTT matches of each selected class (1, 2, 4 and 5) were analysed. The variables analysed were DR (duration of rally) and RT (rest time). In observing the characteristics of the matches in Classes 1, 2, 4 and 5, the DR corresponded to 3.4 ± 1.2 , 4.2 ± 1.5 , 4.5 ± 1.6 and 5.2 ± 1.2 seconds, and RT to 13.8 ± 3.5 , 14 ± 3.5 , 13.3 ± 3.1 and 12.3 ± 3.3 seconds. In Classes 1 and 2, significant differences in DR were found, but none in RT ($p > 0.05$). In the DR and RT of classes 4 and 5 there were significant differences ($p < 0.05$). The results indicated that the DR in Classes 1 and 2 were different because of sitting balance due to severe reduction of function in Class 1 playing arm, interfering in the rally and rest. In Classes 4 and 5 the differences in DR and RT were caused by little sitting balance in Class 4. These characteristics should be used by coaches to check the disadvantages that Class 1 presents against Class 2, and the physical limitations of Class 4 that can directly influence DR in the team tournament against athletes with normal trunk muscle function (Class 5). Planned training prescriptions between classes would aim at achieving better sport performance in training and team tournaments.

Key words: Para table tennis, sitting classes, rally, rest time.

1. Introduction

The table tennis is a sport intermittent effort, with a short duration at effort and rest [1-3]. PTT (Para table tennis) is a disabled sport that are grouped in standing, wheelchair and intellectual. Athletes from disability groups can take part. WTT (wheelchairs table tennis) receive classifications Classes 1-5 by the International Federation of Table Tennis [4]. WTT is an adapted sport the usual table tennis rules are in effect with slight modifications for wheelchair athletes.

A game requires agility and upper arm involvement breaks between the rallies, making players perform short bursts of high-intensity exercise interspersed with periods of rest or low-intensity.

The intermittent nature of the sport in a WTT match means that the players have intermittent exercise bouts and a multitude of rest periods over a long duration. In

this sense studies about sport of rackets have verified specific characteristics [5-10].

The activity patterns and the specific characteristics of the match wheelchair PTT classes should be used in the exercises to improve the training sessions. However, there is no study in PTT that measured the match characteristics. Thus, the purpose of this study was to analyse and compare the match characteristics DR (duration of rally) and RT (rest time) of wheelchair PTT classes that played in the team tournament at the Rio 2016 Paralympics.

2. Material and Methods

2.1 Statistical Analyses

The data are reported as the mean and standard deviation. Before using nonparametric tests, the assumption of normality was confirmed using the Kolmogorov-Smirnov test. The nonparametric Kruskal Wallis were used to compare the DR and RT between the classes that played in the team tournament at the Rio 2016 Paralympics.

Corresponding author: Willian Gabriel Felício da Silva, master of physical education, research field: physiology exercise in racket sports.

2.2 Determination of Characteristic of PTT Matches

Eight PTT matches of each selected class (1, 2, 4 and 5) were analyzed from video recordings (Panasonic S-VHS M9000, Osaka, Japan). The analyses of all matches were performed by the same experienced researcher. Each match was monitored and recorded for subsequent analysis. The DR and RT of wheelchair PTT classes that played in the team tournament at the Rio 2016 Paralympic was performed using free software for video analysis (KINOVEA). DR and the shots per rally were measured individually in all matches using Dartfish note app (Fig. 1), which was used for periods of effort and recovery in the rally similar in other studies [2, 10]. From these data, the following variables were calculated for the eight matches analyzed:

Rally to be decided as a let or a point, and the rest time was measured from this moment (finished rally) until beginning a new service.

RT was determined by the sum of the break time

between points (obtained by subtracting the start time of the point from the finish time of the previous point) in minutes.

3. Results

The characteristics of all PTT matches are shown in Table 1. In observing the characteristics of the matches in Classes 1, 2, 4 and 5, the DR corresponded to 3.4 ± 1.2 , 4.2 ± 1.5 , 4.5 ± 1.6 and 5.2 ± 1.2 seconds, and RT to 13.8 ± 3.5 , 14 ± 3.5 , 13.3 ± 3.1 and 12.3 ± 3.3 seconds. In Classes 1 and 2, significant differences in DR were found, but none in RT ($p > 0.05$). In the DR and RT of Classes 4 and 5 there were significant differences ($p < 0.05$). Figs. 2 and 3 show the frequency of occurrences of the DR and rest time, respectively. The highest activity periods were found between 3 and 4 seconds for DR and the first seconds for rest (less than 14 seconds).

The rally distribution and the recovery time are shown in Figs. 1 and 2.

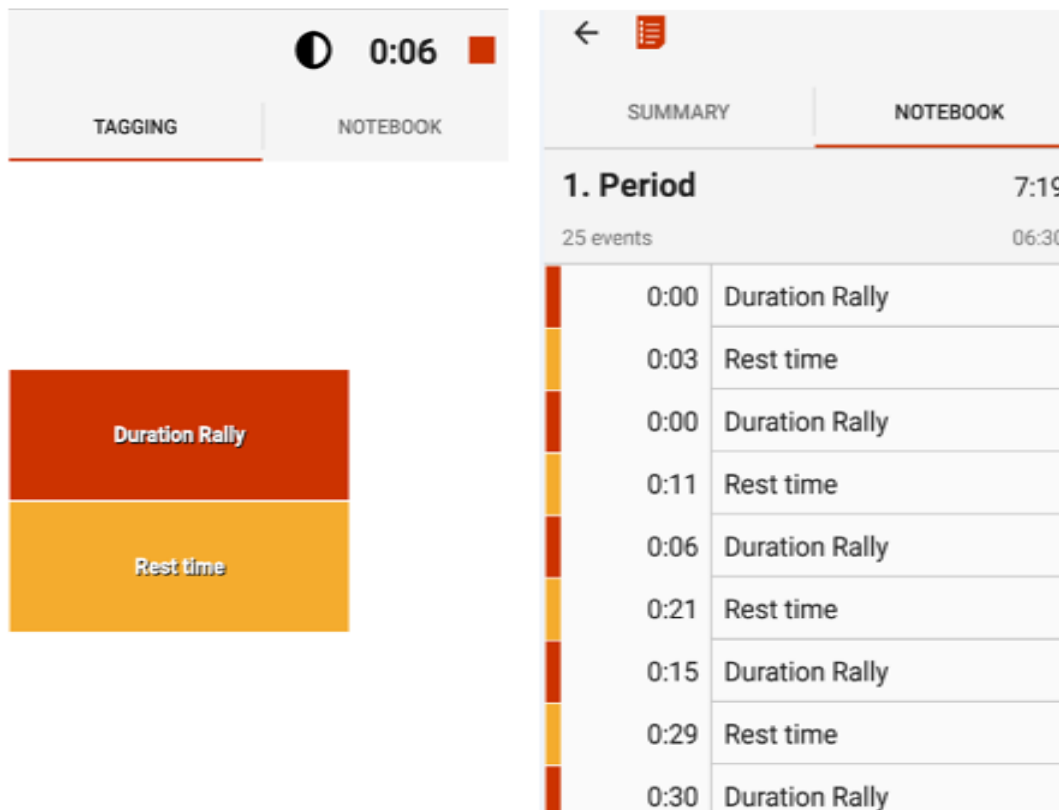


Fig. 1 Dartfish note app with tagging and summary.

**Analysis of the Duration and Rest Time of Wheel Chair Para
Table Tennis at the Rio 2016 Paralympic Games**

Table 1 Characteristics of PTT obtained in all matches.

Classes	DR Mean (\pm SD)	RT Mean (\pm SD)	Range (DR)	Range (DR)
Class 1	4.4 \pm 0.7	13.8 \pm 3.5	2 - 13	4 - 26
Class 2	5.4 \pm 2.1	14 \pm 3.5	2 - 20	5 - 26
Class 4	6.6 \pm 3.6	13.3 \pm 3.1	2 - 25	1 - 22
Class 5	7.2 \pm 4	12.3 \pm 3.3	2 - 29	5 - 25

Abbreviations: DR = duration of rally; RT = rest time.

*The results are shown as mean (SD), and range.

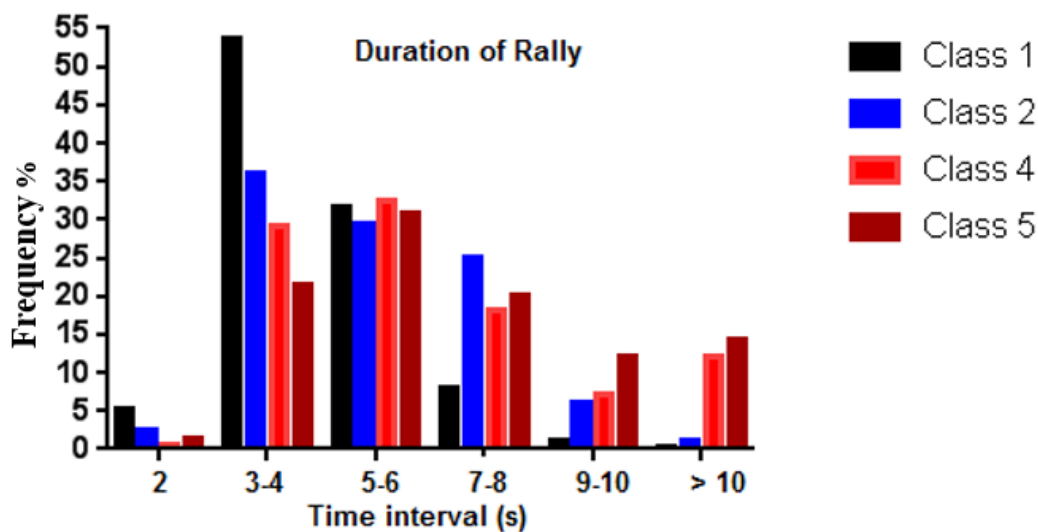


Fig. 2 Distribution of rallies duration during the matches.

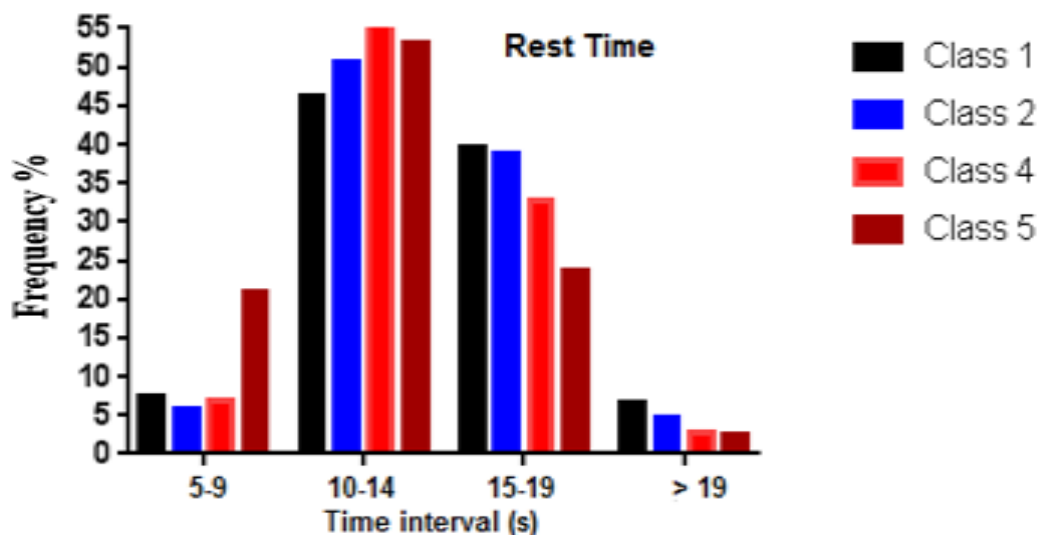


Fig. 3 Distribution of the rest time between rally.

Thus, according to the results of the duration of the rally between Classes 1 and 2 presented significant differences being evidenced that the limitation of the players of Class 1 influences directly when it has to hit the ball of forehand and backhand during the dispute of

the rally, because Class 1 players have no balance and have a reduced arm function and limited balance. The rest time did not present a significant difference because the balls are handed in each player's hand to start the rally, showing that both can be the same. In

Classes 4 and 5, the differences in the duration of the rally and in the rest time occur because although the athletes of Class 4 present a balance is not enough for stabilization of the pelvis, thus compromising their performance during the rally and the rest time, this difference can be a strategy for a very concentration or recovery for new rally.

Therefore, players Classes 2 and 5 when playing the team tournament may have some advantages in the rally for having advantages in the execution strokes.

These results might be used by coaches to plan training prescriptions between classes that would aim at achieving better sport performance in training and team tournaments.

It is important to consider that the limited number of research and restricts scientific information on scientific procedures for coaches [11-14]. Additional studies are still necessary to analyze other temporal variables and profile physiological to prescribe and monitor the wheelchair PTT.

4. Conclusions

Based on the findings from the present study, we can conclude that:

- The duration of the rally is different between PTT classes that play team tournaments together;
- The rest time between the rallies may be different by the strategy of concentration or recovery used by the players;
- The players who have more physical limitations are disadvantaged during the rally in team events in the format of Paralympic games;
- Finally, Classes 2 and 5 have an advantage during the rally in the team tournaments against Classes 1 and 4.

References

[1] Morel, E. A., and Zagatto, A. M. 2008. "Adaptation of the Lactate Minimum, Critical Power and Anaerobic Threshold Tests for Assessment of the Aerobic/Anaerobic Transition in a Protocol Specific for Table Tennis." *Rev. Bras Med.* 14: 523-7.

[2] Zagatto, A. M., Morel, E. A., and Gobatto, C. A. 2010.

"Physiological Responses and Characteristics of Table Tennis Matches Determined in Official Tournaments." *J. Strength Cond. Res.* 24: 942-9.

[3] Sperlich, B., Koehler, K., Holmberg H. C., Zinner, C., and Mester, J. 2011. "Table Tennis: Cardiorespiratory and Metabolic Analysis of Match and Exercise in Elite Junior National Players." *Int. J. Sports Physiol Perform* 6 (2): 234-42.

[4] International Table Tennis Federation. "The Laws of Table Tennis, ITTF Para Table Tennis Classification Handbook." Accessed April 12, 2017. <https://www.ipttc.org/classification/#documents>.

[5] Zagatto, A. M., Papoti, M., and Gobatto, C. A. 2008. "Anaerobic Capacity May Not be Determined by Critical Power Model in Elite Table Tennis Players." *J. Sports Sci. Med.* 7: 54-9.

[6] Fernandes, J., Mendez-Villanueva, A., and Pluim, B. 2006. "Intensity of Tennis Match Play." *Br. J. Sports Med.* 40: 387-91.

[7] Fernandez-Fernandez, J., Mendez-Villanueva, A., Fernandez-Garcia, B., and Terrados, N. (2007). "Match Activity and Physiological Responses during Junior Female Singles Tennis Tournament." *Br J Sports Med* 41: 711-6.

[8] Smekal, G., Von Duvillard, S. P., Rihacek, C., Pokan, R., Hofmann, P., Baron, R., Tschan, H., and Bachl, N. 2001. "A Physiological Profile of Tennis Match Play." *Med. Sci. Sports Exerc.* 33: 999-1005.

[9] Roy, J. L., Menear, K. S., Schmid, M. M., Hunter, G. R., and Malone, L. A. 2006. "Physiological Responses of Skilled Players During a Competitive Wheelchair Tennis Match." *J. Strength Cond. Res.* 20 (3): 665-71.

[10] Filipčič, T., and Filipčič, A. 2009. "Time Characteristics in Wheelchair Tennis Played on Hard Surfaces." *Kinesiology* 41: 67-75.

[11] Sánchez-Pay, A., Torres-Luque, G., and Sanz-Rivas, D. 2016. "Match Activity and Physiological Load in Wheelchair Tennis Players: A Pilot Stud." *Spinal Cord* 54 (3): 229-33.

[12] Martin, C., Favier-Ambrosini, B., Mousset, K., Brault, S., Zouhal, H., and Prioux, J. 2015. "Influence of Playing Style on the Physiological Responses of Offensive Players in Table Tennis." *J. of Sports Medicine and Physical Fitness December* 55 (12): 1517-23.

[13] Katsikadelis, M., Pilianidis, T., and Vasilogambrou, A. 2007. "Real Play Time in Table Tennis Matches in the XXVIII Olympic Games 'Athens 2004'." *Int. J. Table Tennis Sci.* 15: 1-5.

[14] Katsikadelis, M., Pilianidis, T., and Misichroni, A. 2010. "Comparison of Rally Time in XXIX Beijing (2008) and XXVIII Athens (2004) Olympic Table Tennis Tournaments." *Int. J. Table Tennis Sci.* 6: 55-9.