COACHING & SPORT SCIENCE REVIEW

Development of reaction times in young tennis players using the SensoBuzz application

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ABSTRACT

This study is aimed at analyzing young tennis players through an evaluation of the simple reaction times (RTsS) and complex reaction times (RTsC) using the SensoBuzz console, equipped with a chronometer, connected to a release button, three push buttons and two conductance platforms. The SensoBuzz console was used for a first evaluation of the simple and complex reaction times of the young tennis players and a subsequent verification, after three months of training. Following the first measurement, the subjects trained weekly with the help of the SensoBuzz application installed on the coach's device (tennis coach and/or physical trainer) diversifying the workouts on reaction times. After three months of training, the results showed shorter reaction times following the training with the SensoBuzz application compared with training without the SensoBuzz application. More specifically, we observed an effect on simple reaction times when comparing players' training once per week and players training six times per week.

INTRODUCTION

The reaction time is a special coordination capacity, which allows everyone to respond to a stimulus in the shortest possible times (Mead et al., 2000; Jui-Hung Tu et al., 2010; Emre et al., 2010; Uzu et al., 2009). The reaction time is defined as "simple" when a single signal corresponds to a single predetermined action; it is defined as "complex" when the signals can be different, and the response can be chosen among many possible (Buzzelli, 2021; Zajdel & Nowak, 2007; Buzzelli, 2020).

In tennis sport, the reaction times are shorts, especially in the response to the service, which has become more and more a fundamental shot since the speed of the ball in the game phase has had a substantial increase. This is certainly due to the development of new materials for the rackets, today built with increasingly lighter and more performing materials, developed especially for the prevention of injuries. Moreover, a more accurate and specific physical preparation, associated with the nutritional part, has undoubtedly contributed to an increase in the speed of the ball (Senatore & Cannataro, 2019).

In tennis sport, being able in a few milliseconds to prepare, hit the ball and direct it to a specific point of the opposite half of the court, is essential to put the opponent in difficulty. Precisely in this case different coordination skills come into play, also associated with attentional and cognitive aspects, which should be trained daily, to improve the ability to react.

This study analyses young tennis players through an evaluation of simple reaction times (RTsS) and complex reaction times (RTsC) with the aid of a SensoBuzz console.

Knowing that the best way to detect the simple reaction times is to use a handpiece equipped with a release button (Buzzelli, 2021), to allow a correct comparison of the data, the pressure key system was used for the detection of the complex reaction times, which consists of a stopwatch, connected to a release platform, three push buttons and two conductance platforms. This device was used before and after the evaluation tests. Young tennis players have been able to diversify the attentional-cognitive-motor training on reaction times, extremely important in modern tennis. In fact, in addition to the initial tests, an application of the SensoBuzz was used, to train attentional-cognitive-motor training on the tennis court.

To the best of our knowledge, no scientific articles have focused on how to train reaction times in tennis, especially in the youth field, using the described tools.

TOOLS AND METHODOLOGY

Subjects

60 subjects were considered, including 30 males and 30 females, aged between 10 and 16 years. The subjects tested trained from 1 to 6 times a week (1 hour and 30 minutes per training session). Each of them presented a ranking between 3.1 and 4.NC of the classification of the Italian Tennis Federation.

Tools

Two scientific technological tools were used:

1. The SensoBuzz console is a system designed by Salvatore Buzzelli, which evaluates simple and complex reaction times. It is equipped with a chronometer connected to a release button, three pressure keys and two conductance platforms (see Fig.1). The in-house software measured simple reaction times (RTsS) and complex reaction times (RTsC). To evaluate simple reaction times, the visual stimulus used was the yellow color and when the color appeared on the led installed the top left of the console, the young tennis player had to release the button of the handpiece. On the screen placed at the top right of the console was displayed the corresponding reaction times registered between the visual stimulus and the release of the handpiece. To evaluate complex reaction times, the visual stimuli used were three colors: red, yellow, green; the auditory stimuli were two: high and low tone. The tennis young player after receiving the visual and/or auditory stimulus were instructed to press either the press keys on the console, or one of the two conductance platforms located to the right and left side of the young tennis player. This tool was used for a first evaluation of the simple and complex reaction times of the young tennis players and a subsequent verification, after three months of training.

Figure 1. *The figure shows the SensoBuzz console used to evaluate simple and complex reaction times.*

2. The SensoBuzz application is a tool designed to train reaction times in all sports. It is designed and built by Salvatore Buzzelli. This application is dedicated to the analysis and development of some coordination and sensorimotor skills, focusing on attentional skills. Available on devices with Android and iOS systems, it allows to train the reaction times through visual and auditory stimuli provided randomly. The visual stimuli are composed of: 4 colors (green, yellow, red, blue), 4 arrows (top, bottom, right, left), and 4 symbols (x, +, ?, #); the auditory stimuli are two: high and low tones. For each visual and/or auditory stimulus, a motor task is performed. For example, when the green color appears on the device, the young tennis players have to run forward for 3 meters, when the blue color appears on the device the young tennis player have to run to the right for 3 meters, when the device emits a high tone, the young tennis player have to run back three meters.

Methodology

For each subject we collected anamnestic (personal data) and anthropometric data (weight and height). We then proceeded with the measurement of the simplex and complex reaction times through the SensoBuzz console. The simple reaction times was detected with the use of a handpiece equipped with a release button (normally closed circuit).

Specifically, for the detection of the simple reaction times, it was asked to hold down the button on the handpiece, to release it as soon as the stimulus was received and to re-enter it immediately after. This made it possible to process the reaction times by the instrument and to view it in real times on the display of the SensoBuzz console.

The complex reaction times was always detected with the use of the SensoBuzz console, on which three pressure buttons of different colors were positioned and to which two platforms, also of different colors, were connected to the ground (normally closed circuit).

Each subject was asked to react to stimuli either with the use of the hands (in the simple reaction times) or with the use of the feet (in the complex reaction times).

To measure complex reaction times, we used different colors corresponding to three visual signals and platforms of two different colors, each placed on the sides of the examiner's feet.

The number of stimuli emitted was five for the simple reaction times and ten for the complex reaction times.

Three months after the first training session, all subjects were re-examined following the same procedure.

Based on the initial evaluation, subjects were distributed in three study groups and one control group:

- Group 1: 10 subjects trained 1 time a week for 20 minutes with the SensoBuzz application.

- Group 2: 10 subjects trained 3 time a week for 20 minutes with the SensoBuzz application.

- Group 3: 10 subjects trained 6 time a week for 20 minutes with the SensoBuzz application.

- Control group: 30 subjects trained 6 time a week for 20 minutes without the SensoBuzz application.

During each training session, the study groups used the SensoBuzz application, installed on the coach's device, while the control group trained without the use of the SensoBuzz application. After three months of training, we evaluated the reaction times with the SensoBuzz console.

All subjects were tested in indoor courts, with an average atmospheric temperature of 8° C. Each training session provided four young tennis players and an expert (tennis coach and/or physical trainer) on the court. During the weekly training sessions, lasting 1 hour and 30 minutes, the young tennis players trained for about 20 minutes only on reaction times. The trainings were carried out with random exercises by both the tennis coach and the physical trainer and took place on a single surface, fast in resin glass, in order to have as a parameter a single reference surface.

ANALYSIS

Data were analyzed using the following measures: RTsS, RTsC, RTs control group.

We performed 4 different analyses.

In order to pinpoint a reduction in reaction times due to the use of the SensoBuzz application, in the first analysis we compared RTsS registered from players that used SensoBuzz application versus RTs of the control group (training without the use of the SensoBuzz application).

Similarly, the second analysis compared RTsC registered from players that used SensoBuzz application to RTs of the control group (training without the use of the SensoBuzz application).

Differences between RTsS and RTs control group, and RTsC vs. RTs control group were highlighted using paired sample t-tests.

The third and fourth analysis were performed aiming to demonstrate an effect of training due to the SensoBuzz application. Thus, simple and complex RTs were analyzed for different Types of Training (one a week, three times per week, six times per week). Differences in RTsS and RTsC per Type of Training (one time per week, three times per week, six times per week) were entered separately into an Analysis of Variance (ANOVA) with Type of Training as between-subjects factor. Post-hoc analyses were conducted via pairwise comparisons (t-tests). We used Holm correction for all comparisons.

RESULTS

RTs simple versus RTs control group

The paired t-test indicated a significant difference between RTsS and RTs control group ($p < .001$) showing shorter RTsS compared to RTs of the control group.
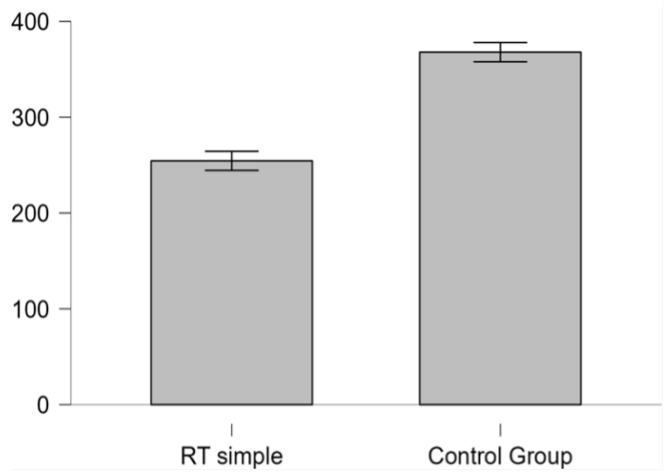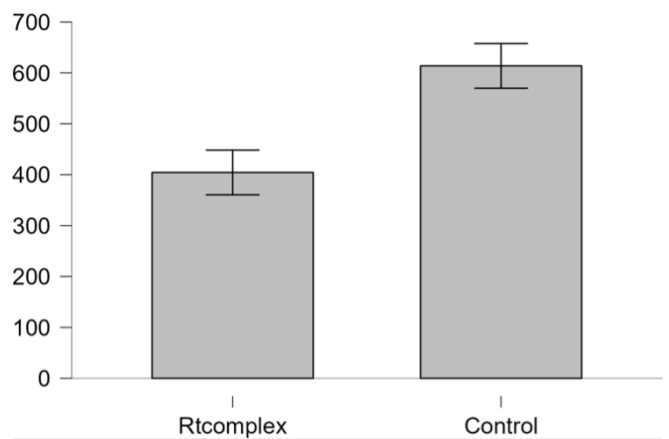

Figure 2. *The figure shows the average of RTsS measured from the study groups compared to the average of RTs measured from the control group. The bars represent the standard deviation from the average. The y-axis displays RTs in ms.*

The paired t-test indicated a significant difference between RTsC and RTs control group ($p < .001$) showing shorter RTsC compared to RTs of the control group.

Figure 3. *The figure shows the average of RTsC measured from the study groups compared to the average of RTs measured from the Control Group. The bars represent the standard deviation from the average. The y-axis displays RTs in ms.*

RTsS and RTsC for different training

The ANOVA indicated a significant main effect of Type of Training [$F_{(2, 27)}$ = 10.080, p < .001], a main effect of RTs [$F_{(1, 27)}$ = 227.676, p < .001], the interaction RTs*Type of Training [$F_{(2, 27)}$ = 0.586, p = .564] was not significant.

To assess differences between RTsS and RTsC, and between Types of Training post hoc comparisons were performed. We observed a statistically significant difference in the RTsS compared to RTsC (p<.001) with shorter RTsS compared to RTsC.

We also observed significant differences between all Types of Training (Training one time per week vs. Training three times per week, p =.048; Training one time per week vs. Training six times per week, p <.001; Training three times per week vs. Training six times per week, p =.048) showing shorter RTs in players that trained six times per week compared to players that trained one and three times per week.

Additionally, post hoc comparisons were performed per Type of Training across different RTs (simple, complex). The results highlighted significant differences in RTsS between players that trained one time per week and players that trained six times per week (p = .002) showing shorter RTs in the second compared to the first. No other significant differences were observed.
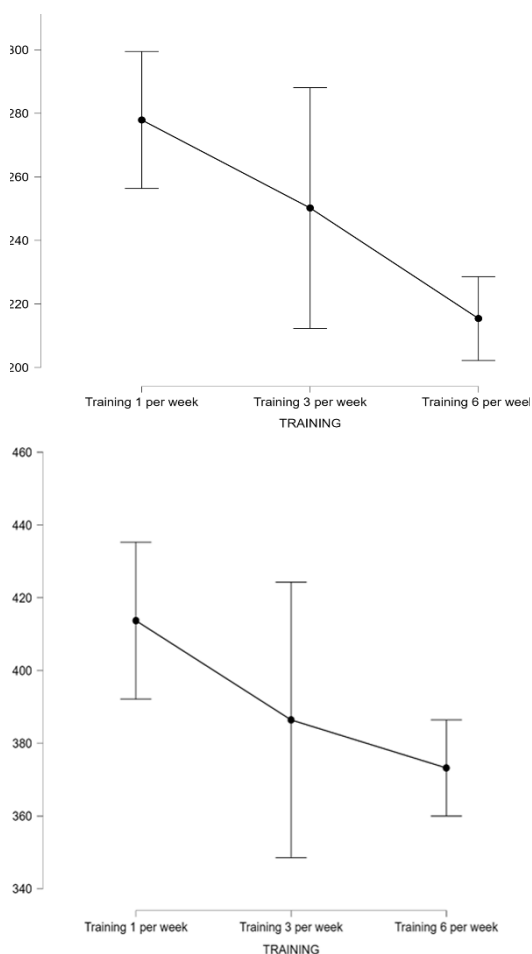

Figure 4. *The figures show the comparison of the RTs simple (left) and RTs complex (right) measured during the various Types of Training (Training one time per week, Training three times per week, Training six times per week).*

CONCLUSIONS

The present study demonstrates, for the first time ever, that training with SensoBuzz application results in shorter reaction times in young tennis players compared to training without SensoBuzz application.

Moreover, different reaction times were associated to the amount of training (one, three or six times per week) with the SensoBuzz application showing faster RTsS in the players that trained six times per week compared to those who trained one and three times per week. The use of SensoBuzz application seems to do not influence RTsC in any of the Types of Training tested in this study.

Therefore, more young tennis players train with the SensoBuzz application shorter the simple reaction times measured.

We hypothesized that young tennis players using SensoBuzz application could shortened their RTs especially in response to the service of the opponent leading thus to an increase of speed, effectiveness, technic and tactic. Future research may address this point more specifically.

Modern tennis is more dynamic and faster compared to the tennis played years ago. Thanks to the training described in the previous section, players may increase their effectiveness and awareness due to an improvement of essential coordination capabilities: the ability to react (more assimilable in adolescence than in adulthood).

Finally, the use of SensoBuzz application during training results in boosted sensory and cognitive activations also due to the processing of visual and auditory stimuli which in turns led to an enhancement of attentional and motor responses, motivating the player to improve daily.

CONFLICT OF INTEREST AND FUNDING

REFERENCES

Ak, E., & Koçak, S. (2010). Coincidence-anticipation timing and reaction time in youth tennis and table tennis players. Perceptual and motor skills, 110(3), 879-887.

Buzzelli S. (2020), The "Sigma Test": a new methodology for evaluating a tennis player, I.T.F. Coaching & Sport Science Review, vol. 28 No. 82. https://doi.org/10.52383/itfcoaching.v28i82.7

Buzzelli S. (2021), From "sigma test" to customized training, I.T.F. Coaching & Sport Science Review, vol. 29 No. 84. https://doi.org/10.52383/itfcoaching.v29i84.142

Mead, T. P., Drowatzky, J. N., & Hardin-Crosby, L. (2000). Positive and negative stimuli in relation to tennis players' reaction time. Perceptual and Motor Skills, 90(1), 236-240. https://doi.org/10.2466/ pms.2000.90.1.236

Plunkett, C. (1967). The effect of the psychological components of competition on reaction time in tennis (Doctoral dissertation, University of North Carolina at Grennsboro).

Rotella, R. J., & Bunker, L. K. (1978). Field dependence and reaction time in senior tennis players (65 and over). Perceptual and Motor Skills, 46(2), 585-586. https://doi.org/10.2466/ pms.1978.46.2.585

Tu, J. H., Lin, Y. F., & Chin, S. C. (2010). The influence of ball velocity and court illumination on reaction time for tennis volley. Journal of Sports Science & Medicine, 9(1), 56.

Senatore F, Cannataro R. (2019), The energy expenditure in the 5 types of modern tennis players, I.T.F. Coaching & Sport Science Review, vol. 27 No. 78. https://doi.org/10.52383/itfcoaching.v27i78.93

Uzu R, et al. (2009), A split-step shortens the time to perform a choice reaction step-and-reach movement in a simulated tennis task, Journal Sports Sci, article. https://doi.org/10.1080/02640410903233222

Zajdel, R., & Nowak, D. (2007). Simple and complex reaction time measurement: a preliminary evaluation of new approach and diagnostic tool. Computers in biology and medicine, 37(12), 1724-1730. https://doi.org/10.1016/j.compbiomed.2007.04.008

Ziagkas E, et al. (2018), The effect of a 12-week reaction time training using active video game tennis attack on reaction time and tennis performance, Interactive Mobile Communication Technologies and Learning. https://doi.org/10.1007/978-3-319-75175-7_63

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