

VALIDITY OF THE NEW POWERTAP POWERMETER AND AXIOM CYCLE ERGOMETER WHEN COMPARED WITH AN SRM DEVICE

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INTRODUCTION

It is common to use laboratory tests in order to evaluate the performance of competitive cyclists. The difference between the winner and the second placed cyclist for track cycling is very small. In this condition it is very important to use a valid and reliable ergometer for tracking small changes in performance.

The aim of this study was to compare two new cycle ergometers, Axiom (Elite, Italy) and PowerTap (CycleOps, USA) with the SRM reference ergometer during maximal intensity exercise (sprint) and during sub maximal intensity exercise (only PowerTap vs SRM). The Axiom is an stationary electromagnetically ergometer which permits utilisation of the cyclist personal bicycle. The PowerTap is a mobile cycling powermeter that measures the power output with strain gauges localised in the hub of the rear wheel. The SRM system is a crankset that measures power output from torque and angular velocity continuously. The torque is thereby calculated by strain gauges (depending on the model 4, 8 or 20 strain gauges) that are located between the crank axle and the chainring.

METHODS

Ten male competitive cyclists (age 25 ± 3 years, height 180 ± 5 cm, body mass 70.2 ± 4.7 kg) participated in the study. The study comprised two sprint tests in seated position on the Axiom ergometer. Tests were performed on the race bicycle equipped with the PowerTap and SRM ergometers against a 0.6 N/kg resistive loads. The exercise at sub maximal intensity (50 to 400 W) was performed on a treadmill (S 1830, HEF Tecmachine, Andrézieux-Bouthéon, France).

The three ergometers sampled (1 Hz) and stored the power output and the pedalling cadence (rpm). The maximal performance was determined by the maximal power output value. After testing our data for normality and homogeneity of variance, a correlation coefficient, bias, limits of agreement and 95% confidence interval (95% CI) (Bland and Altman, 1986) were calculated to quantify the differences between PowerTap and SRM power output. The analysis of mean differences between the Axiom, PowerTap and SRM power output were assessed with paired Wilcoxon tests, and significant difference was set at $P < 0.05$.

RESULTS AND DISCUSSION

During maximal power output test, the results indicate that the Axiom values were significantly lower ($p < 0.05$) compared with SRM and PowerTap values. Axiom ergometer underestimates the SRM and PowerTap values by 29 and 30 %, respectively (Figure 1). During exercise at sub maximal intensity, the regression analyses between the PowerTap and

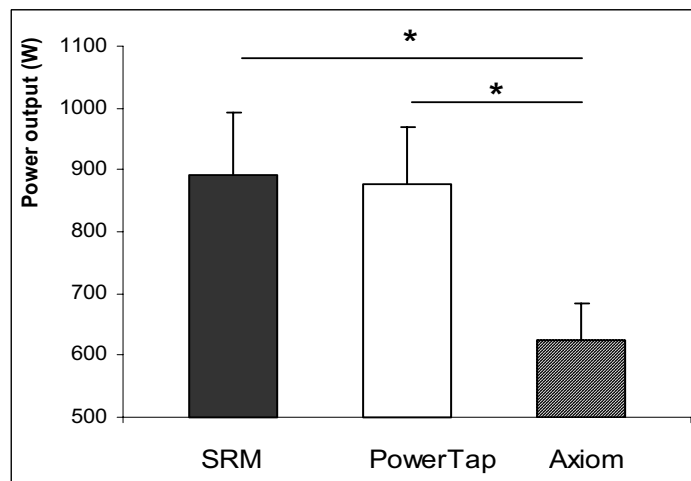


Figure 1 SRM, PowerTap and Axiom maximal power output values during sprint tests.

* : significantly different ($p < 0.05$) compared with Axiom

SRM power output indicate a high correlation ($r = 0.99$, $p < 0.001$). The mean differences power output measurement lay between 2.61 and 3.51 W. The mean bias for power output between PowerTap and SRM was 3.1 ± 3.4 W.

These results indicate that the PowerTap device does provide a valid measure compared with SRM at sub and maximal exercise intensity. The lower bias value indicates that the mean SRM overestimation was only 3 ± 3 W. However, the Axiom was not a valid ergometer when the maximal power output was tested. This result is in accordance with Bertucci et al. [1] who have tested the Axiom validity that shown the Axiom was not valid compared with the SRM during sub maximal intensity exercise. The difference between the SRM and the Axiom device can be explained by the difference between the power output calculation mode. The Axiom power output was calculated from the dubious polynomial equation on the software (taking into account the roller velocity and the braking torque) whereas the SRM and PowerTap ergometer measure the power output from the stain gauges technology.

CONCLUSIONS

This study suggests that the PowerTap mobile cycling powermeter is valid (contrary to Axiom device) for performed scientific studies in the laboratory or in the actual cycling locomotion.

REFERENCES

1. Bertucci W, et al.. *Int J Sports Med* **26(1)**, 59-65, 2005.