

INFLUENCE OF A CUSTOM MADE MAXILLARY MOUTHGUARD ON EXERCISE PERFORMANCE OF AMATEUR ROAD CYCLISTS.

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Background

It has recently been demonstrated that wearing dental mouthguards may positively affect muscle strength, ventilation and oxygen consumption during high-intensity exercise.

However, discordant results have been obtained by several authors probably because of different scientific design, testing protocols and athletes considered.

Aim

To evaluate the influence of a custom made maxillary mouthguard (Parabite Malpezzi®, PM) on submaximal and maximal physiological parameters determining performance in road cycling.

Methods

Subjects: 10 well-trained amateur road male cyclists. All athletes performing 10.000 ÷ 15.000 km/year at least for 10 years.

Their age, height, body mass, and BMI were (mean ± SD) 34±6 yr, 178±7 cm, 70±9 kg, 22±2.5 kg/m², respectively.

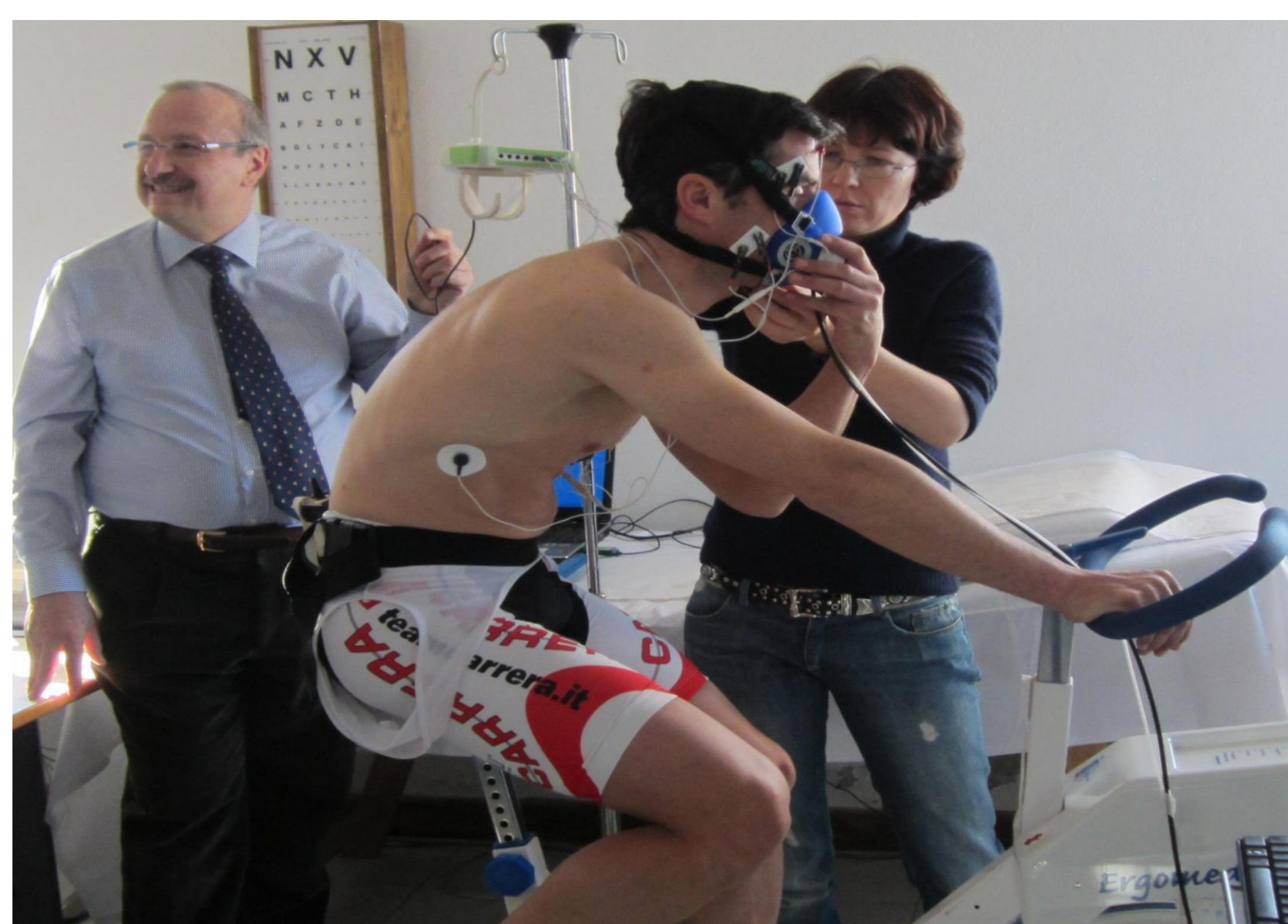
Mouthguard: Parabite Malpezzi® (Figure 1) is a custom-made mouthguard made by an original method based on gnathological and anthropometric parameters. PM has both protective and occlusal equalizing function, which permits to eliminate any kind of malocclusion and leads to better clench of the jaw by improving mechanical occlusal contact.

Figure 1.



The mouthguard was made from thermoplastic nylon with injection technique (Valplast) for dental use.

Testing protocol: After a 5-minute warm-up at 25 Watt all athletes performed an incremental cardiopulmonary test until exhaustion on a frictional braked cycle ergometer (Monark 839 E, Stockholm, Sweden), with work rate (WR) increase of 15 watts per minute at a freely chosen pedaling cadence.



WR, heart rate (HR), oxygen consumption (VO₂), carbon dioxide production, and ventilation at Lactate Threshold (LT), at Respiratory Compensation Point (RCP) and at maximal exercise (MAX) were determined in normal condition (N) and wearing PM. Cycling economy was also evaluated by analyzing the slope of the VO₂/WR (Δ VO₂/ΔWR, ml/watt/min) relationship during the test in the two experimental conditions.

PM was worn by athletes from 3 to 90 days before testing. All subjects performed the test without PM on a first day and wearing PM on the following day.

The participants were strongly instructed not to clench their teeth during inhaling and exhaling during the first session (without PM). In contrast, wearing the PM in the next day's session, they were instructed to clench their teeth but only while inhaling.

Data analysis: Results are expressed as means ± SD. A repeated measures design was used to evaluate differences between mean values. Paired T-test was used to compare the two experimental conditions. The level of significance was set at 0.05.

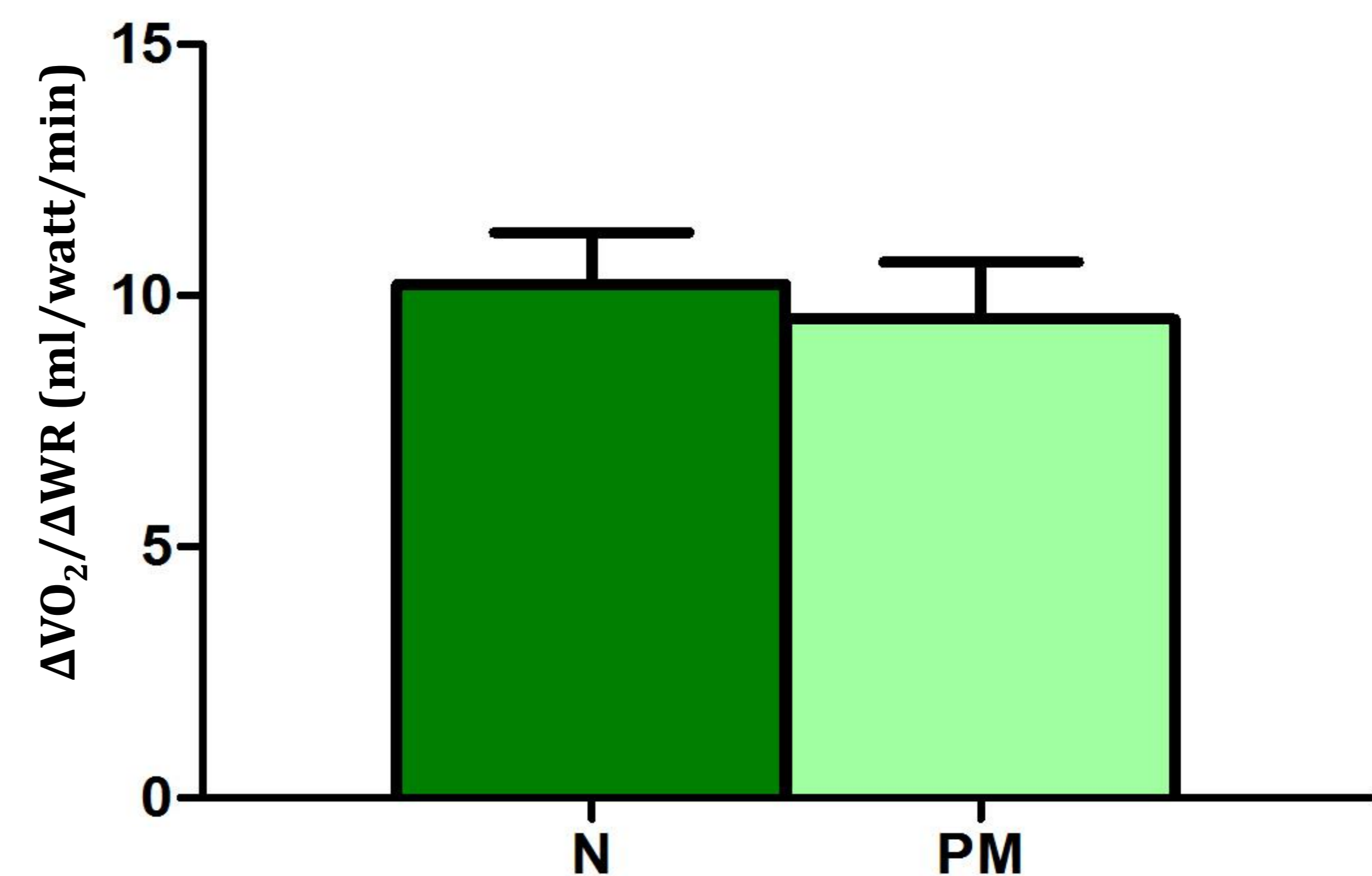
Results

Submaximal and maximal results obtained are presented in Table 1.

Wearing PM compared to N resulted in an average significant 7 % and 4% increases of WR at RCP (288±47 vs 270±34 watts, P=0.01) and at MAX (353±44 vs 339±38 watts, P=0.004) respectively.

| | W (watt) | HR (bpm) | VO ₂ (ml/kg/min) |
|------------|----------|----------|-----------------------------|
| MAX | | | |
| N | 339 ± 38 | 180 ± 6 | 57,8 ± 6,6 |
| PM | 353 ± 44 | 182 ± 8 | 58,1 ± 5,8 |
| P | 0,004 | N.S. | N.S |
| RCP | | | |
| N | 270 ± 34 | 162 ± 7 | 47,7 ± 7,0 |
| PM | 288 ± 47 | 164 ± 8 | 50,6 ± 4,2 |
| P | 0,01 | N.S. | N.S |
| LT | | | |
| N | 207 ± 35 | 142 ± 12 | 40,8 ± 5,3 |
| PM | 204 ± 44 | 139 ± 11 | 41,3 ± 3,7 |
| P | N.S | N.S | N.S |

Wearing PM also resulted in a 8% lower Δ VO₂/ΔWR (9.5±1.1 vs 10.3±1.1 ml/watt/min, P=0.06)



Any other physiological parameter examined was not significantly affected by wearing PM.

Conclusions

Wearing individually fitted maxillary mouthguard significantly enhanced power output at higher submaximal exercise intensity (Respiratory Compensation Point) and at maximal effort. Using PM also improved cycling economy.

Wearing PM positively influenced physiological parameters associated with road-cycling performance.

These preliminary results provide support to encourage athletes to correct jaw posture and occlusal clench in order to improve exercise performance.