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Breathing parameters associated to two different external nasal dilator strips in endurance athletes

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ABSTRACT

Objective: The aim of the study was to investigate and compare the effects of two different external nasal dilator strips (ENDS) on nasal respiratory flow, maximal oxygen uptake (VO₂max), nasal VO₂max, time to exhaustion and subjective nasal obstruction in adult triathletes participating in exhaustive, controlled physical exercise tests.

Methods: Thirteen healthy triathletes without nasal symptoms were recruited and randomly tested in three different conditions: without ENDS, wearing the Breathe Right[®] dilator strip and wearing the Master-aid Roll-flex[®] strip. We investigated the variations in the peak nasal inspiratory flow (PNIF) and the Nasal Obstruction Symptom Evaluation questionnaire before and after an exhaustive treadmill test. VO₂max, nasal VO₂max, time to exhaustion, total time of nasal respiration values were also registered and compared.

Results: Post-exercise PNIF was higher than the pre-exercise PNIF. Pre-exercise PNIF was higher in athletes wearing the Master-aid Roll-Flex[®] than in those wearing the Breathe Right[®] strips; no differences in post-exercise PNIF values were found in the three different conditions. Nasal VO₂max value was higher when both types of ENDS were worn. Nasal respiration time to exhaustion was longer when the athletes were wearing either type of ENDS. Both ENDS gave a better sensation of nasal airflow passage after physical exercise.

Conclusion: ENDS had similar effects, improving the subjective sensation of nasal patency, the nasal respiration time, and the nasal VO₂max, anyway Master-aid Roll-flex[®] is more economic than the Breathe Right[®] and it can be cut to fit the nasal anatomy.

As ENDS affect the cross-sectional area, especially at the level of the nasal valve, in future studies should be conducted also by means of acoustic rhinometry in order to evaluate if any difference could be found at this level when wearing either one of the two ENDS.

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1. Introduction

Since nasal function has historically been associated to performance in aerobic exercise, nasal respiratory function during physical exercise has been extensively investigated. Exercise causes a decrease in nasal mucosa congestion similar to that observed with the application of a nasal decongestant,

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such as oxymetazoline hydrochloride. Exercise promotes a drop in total nasal airway resistance within 30 s that is maximal at 5 min and may persist for up to 30 min once aerobic performance has ceased [1,2].

Triathlon is a multiple-stage competition involving the completion of three continuous, sequential endurance disciplines: swimming, cycling and running in immediate succession over various distances. The popularity of ultra-endurance triathlon activities (3.8 km swim, 180 km cycle, 42.2 km run) has greatly increased since the first modern long-distance Ironman event was held in 1978 [3].

In view of evidence that external nasal dilator strips (ENDS) favor better nasal function by reducing nasal respiratory work, increasing nasal ventilation, improving the temperature and the humidity of inhaled air, and delaying the onset of oral respiration during exercise, they have begun to be considered useful by some athletes and trainers [4–6]. According to some reports, ENDS improve nasal function and enhance alveolar gas exchange, blood oxygenation, and aerobic performance [7,8]. One study assessing healthy adolescent athletes after submaximal exercise while wearing ENDS found improved maximal oxygen uptake (VO_2max), nasal patency, and respiratory effort [9].

The Breathe Right[®] (GlaxoSmithKline, Brentford, UK) (Fig. 1A) nasal dilator strip, which is able to produce a spread of the upper lateral cartilages [10], is usually sold in packages of ten single-use disposable strips at a cost of about 10 euro. Master-aid Roll-flex[®] (5 cm width) (Pietrasanta Pharma Spa, Lucca, Italy) are rolls (5 m long) of adhesive gauze that can be cut into pieces for single use; it is possible to obtain about 100 strips per pack at a cost of approximately 10 euro. Since the tape can be modified to accommodate the external nasal anatomy, it is possible to obtain, together with an upper lateral spread, the elevation of the tip of the nose (Fig. 1B).

The aim of the present study was to investigate the effects of the Breathe Right[®] and Master-aid Roll-flex[®] dilator strips on nasal respiratory flow, VO_2max , nasal VO_2max , and subjective judgment of nasal obstruction in a cohort of healthy adult triathletes performing controlled exhaustive physical exercise.

2. Material and methods

Thirteen Caucasian volunteers [8 males and 5 females between 23 and 59 years (mean age 38.2 ± 11.0 years, mean body weight 67.4 ± 8.7 kg, mean height 173.0 ± 9.1 cm)] who were healthy triathletes involved in competitive activity were recruited. The study's eligibility criteria were scoring less than 1 on the Sino-Nasal Outcome Test (SNOT 22) [11], which assesses nasal symptoms, and a normal body mass index ($<25.0 \text{ kg m}^{-2}$). Its exclusion criteria were being a smoker, being asthmatic, history of sino-nasal surgery, cardiovascular, pulmonary, orthopedic diseases. All the subjects recruited were asked to submit to a full physical examination during which they were asked about medications they were taking (none). The investigation, conducted in accordance with the 1996 Helsinki Declaration and with current Italian laws, was approved by the internal committee of the Section. All the subjects

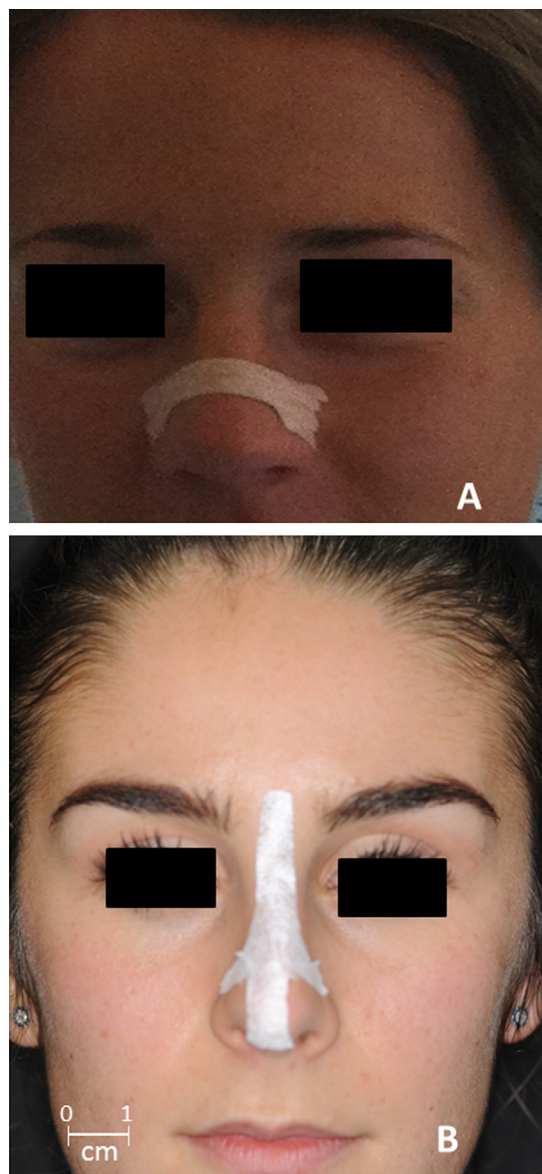


Fig. 1. (A) Breathe Right[®] (GlaxoSmithKline, Brentford, UK) nasal dilator strip. (B) Master-aid Roll-flex[®] (Pietrasanta Pharma Spa, Lucca, Italy) cut in order to obtain an upper lateral spread together with the elevation of the tip of the nose.

eligible to participate in the study were asked to sign written informed consent forms.

The participants were randomly tested by a single group of trained investigators in three different conditions: wearing no dilators, wearing the Breathe Right[®] strips, wearing the Master-aid Roll-flex[®] strips previously cut as shown in Fig. 2 following a template of two possible dimensions (Fig. 3) [protocol number utility patent 278.120 (10/6/2014)] in order to obtain the upper lateral spread and the elevation of the tip of the nose. The three test sessions were held at least 1 week apart from one another. The participants were asked to eat a balanced diet, to avoid coffee, drugs, alcoholic drinks, and exhaustive exercise and to maintain a regular sleeping pattern during the 2 days preceding the test sessions. On test days, the participants were asked to come to the test laboratory (kept at a constant temperature between 20 and 22 °C) in the afternoon (at least

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