Abstract 2019

Evaluation of the effectiveness of an anti-vibration MTB handlebar compared to a traditional MTB handlebar

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Abstract

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Background: Exposure to mechanical vibration during road cycling is a potential risk factor for injuries or musculoskeletal disorders such as the ulnar tunnel syndrome (Akuthota et al., 2005: The American Journal of Sports Medicine, 33, 1224-1230) that results in impaired handgrip force, reduced mobility and pain in both the hands and arms (Radwin et al., 1987: Ergonomics, 30, 833-855). Over the last decade, bike manufacturers have designed anti-vibration components to prevent such symptoms. A recent study showed that new ergonomic MTB grips could prevent fatigue by reducing both vibrations and muscular activity in the forearm while preserving maximal handgrip force (Scholler et al., 2018: Journal of Science & Cycling, 7).

Purpose: The purpose of this study was to evaluate the effectiveness of a new anti-vibration MTB handlebar (BAM City, Red-Motion, St-Jean-de-Soudain, France) compared to a traditional MTB handlebar. We hypothesised that the vibrations transmitted to the wrist are reduced whilst the maximal hand grip force is preserved by using an anti-vibration handlebar.

Figure 1. BAM City anti-vibration handlebar

Methods: Ten cyclists voluntarily participated in this study (mean ± SD: 25.9 ± 7.6 years old; 1.76 ± 0.05 m; 71 ± 8 kg). None of them had a prior experience with an anti-vibration handlebar that could affect the results of this study. Each subject performed a one-day laboratory test that included two pedalling exercises of 20-minutes at 150 W and with a pedaling frequency of 80 rpm, on a hardtail MTB with 26” wheels (Look 986, Look Cycle, France) mounted onto an electromagnetic-braked ergometer (Sartorius, Tacx, Groningen, The Netherlands) with (1) a traditional aluminium handlebar and (2) an anti-vibration handlebar. Each pedalling exercise included two 9-minute periods of pedalling vibrations (3 × 3 min) with vibrations interspersed by 2 minutes of pedalling without vibrations. Vertical vibrations were generated under the front wheel of the MTB by a vibrating plate (Physioplate, Globus, Codogné, Italy) and vibration frequency was changed every 3 minutes from 12 to 56 Hz in a random order. Transmissibility of vertical vibrations between the extremity of the handlebar and the wrist was measured by two three-axis accelerometers (Trigno, Delsys, USA) at 150 Hz. Surface EMG activity of the flexor carpi radialis (FCR), extensor digitorum (ED), biceps brachii (BB) and triceps brachii (TB) of the right upper limb was measured continuously by Trigno sensors at 2000 Hz. At the end of each 3-minutes pedalling bout with vibrations, the subjects were instructed to report their rating of perceived comfort (RPC) on a subjective scale graded from 0 (very high discomfort) to 10 (very high comfort) following a methodology close to that of Verma et al. (2016: Journal of Electromyography and Kinesiology, 27,78-86). Maximal right handgrip force was measured with a handgrip force transducer (MLT 004/ST, AD Instruments, New South Wales, Australia) 1 minute before each pedalling exercise and 1, 10 and 20 minutes after the end of each pedalling exercise. All the subjects had 20 minutes of recovery time between the two pedalling exercises.

Results: Vertical vibrations transmitted to the wrist were significantly reduced with the anti-vibration handlebar at all vibration frequencies except at 12 Hz (Figure 2). Maximal handgrip force was reduced after the 20-minutes pedalling exercise by 7% with the anti-vibration handlebar, but contrary to the traditional handlebar, the values of maximal handgrip force measured at post-10 and post-20 minutes were not significantly different from the pre-value (Figure 3). Muscular activity and rating of perceived comfort were not significantly different between the two MTB handlebars whatever the vibration frequency.

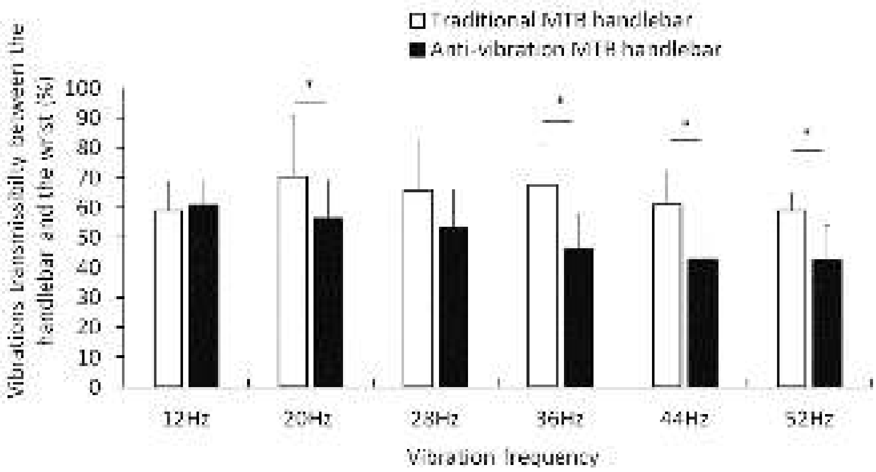

*Figure 2. Transmissibility of vertical vibrations between the handlebar and the wrist measured with traditional and anti-vibration MTB handlebars during each 3-minutes pedalling bouts with vibrations. *: significant difference ($p < 0.05$)*

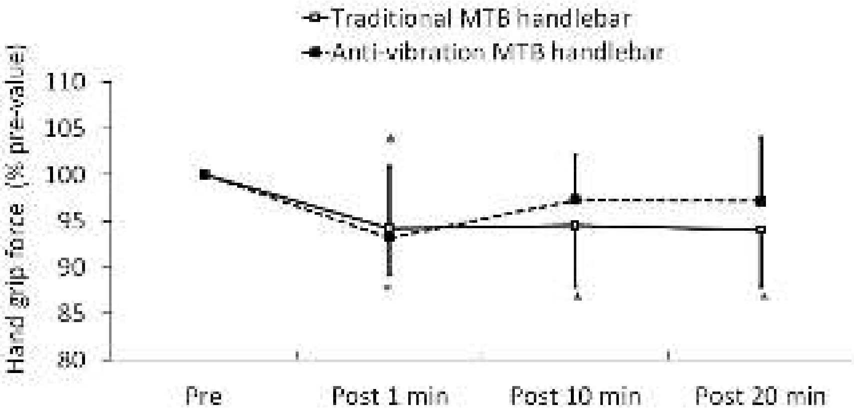

*Figure 3. Maximal hand grip force measured before (pre), 1 min, 10 min and 20 min after (post) the pedalling exercise with vibrations performed with traditional and anti-vibration MTB handlebars. *: significant difference compared to pre-value ($p < 0.05$)*

Discussion and conclusion: This study has demonstrated the effectiveness of an anti-vibration MTB handlebar for decreasing the vibrations transmitted to the wrist but neither for reducing upper limb muscular recruitment nor for improving perceived comfort. However, the recovery of the handgrip force ability seems to be faster after the 20-minutes pedalling exercise performed with the anti-vibration handlebar. Therefore, the use of an anti-vibration handlebar like the BAM City would allow mountain bikers to maintain their full ability for bike handling and effective braking.

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