EFFECT OF VARIOUS TYPES OF METRO-RHYTHMIC STIMULATIONS ON THE GAIT SYMMETRY IN HEALTHY PEOPLE

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Aim of study

The aim of the study was to assess the immediate effect of rhythmic auditory stimulation on the gait symmetry in healthy people.

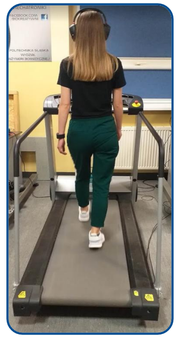
Material and Methods

The research-related tests involved 22 adults without locomotor systems disorders and locomotor dysfunction.

The test participants were divided into two groups, each of which consisted of 11 members:

- Group 1 (age: 23.1±1.6 years, weight: 66.1±22.4 kg, body height: 171.9±11.6 cm) was composed of persons who were not instructed before the test that during gait with metro-rhythmic stimulation they should try to adjust their gait frequency to the sounds they heard,
- Group 2 (age: 26.3±7.2 years, weight: 65.9±9.1 kg, body height: 170.3±8.3 cm) included persons clearly instructed before the test that they should walk in the rhythm of music (metro-rhythmic stimulation).

The tests of gait were performed using a ZEBRIS FDM-T treadmill (ZebrisMedical GmbH, Isny, Germany). Before the tests, the preferable velocity of gait on the treadmill was identified for each person. Afterwards, a test participant walked on the treadmill for approximately 1 minute. The subsequent phase involved the recording of gait with the preferable velocity (GP) for 60 seconds (GP). The recording also involved the gait of persons accompanied by metro-rhythmic stimulation, during which the treadmill speed was adjusted at the value of preferable velocity declared by the participant. Before each test involving metro-rhythmic stimulation, a tested participant walked on the treadmill for 30 seconds, after which a sound stimulus was played. Gait accompanied by sounds lasted 60 seconds.



Studies were conducted for the following types of stimulation:

- GA - arrhythmic stimulus played at a rate of 120 BPM, time 4/4, ambient style. The music had a relaxing function, which could influence the symmetry and calming of the gait.
- GR - rhythmic stimulus played at a rate corresponding to the frequency of gait and determined during tests of preferable speed, time 4/4, motivating music.
- GR110 - rhythmic stimulus played at a rate corresponding to gait frequency increased by 10%; the tempo was determined during the tests of gait at a preferable speed.
- GR200 - rhythmic stimulus played at a rate corresponding to doubled gait frequency; the tempo was determined during the tests of gait at a preferable speed.

The assessment was focused on the susceptibility of healthy adults to metro-rhythmic stimuli and their effect on the primary biomechanical parameters of gait. A detailed analysis was concerned with the changes in the symmetry index (SI) of stepping time and step length determined in accordance with the following formula:

$$SI = \left|\frac{(X_L - X_R)}{0.5(X_L + X_R)} * 100\%\right|$$

where: X_L, X_R – gait parameter value for the left / right lower limb.

When SI=0, the gait parameter is symmetrical. The degree of deviation from 0 indicates the level of asymmetry of a parameter.

Results

Figures 1 and 2 present values of the symmetry index for step time and step length in relation to the tests without sounds and the tests accompanied by various metro-rhythmic stimulations in groups 1 and 2. The number of the test participants in relation to whom the symmetry of analysed parameters remained the same or improved as a result of sound stimuli is presented in percentage in Figures 3 and 4.

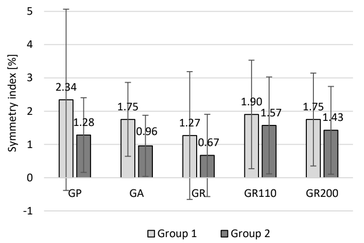


Fig. 1. Symmetry index of step time for the test without sounds and the test with metro-rhythmic stimulation

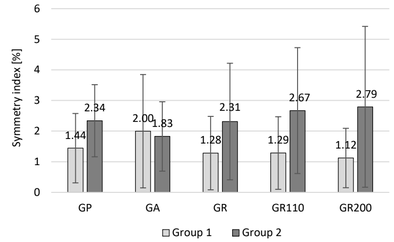


Fig. 2. Symmetry index of step length for the test without sounds and the test with metro-rhythmic stimulation

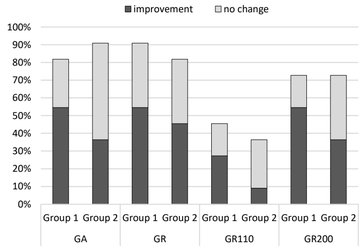


Fig. 3. Number of test participants (in %), in relation to whom the symmetry of step time remained the same or improved as a result of the application of sound stimuli

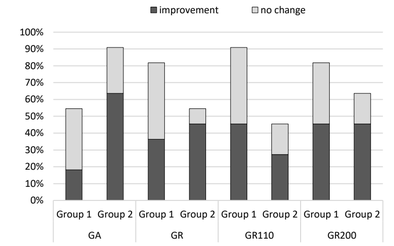


Fig. 4. Number of test participants (in %), in relation to whom the symmetry of step length remained the same or improved as a result of the application of sound stimuli

Conclusions

Short-term rhythmic sound stimuli at the rate equal to stepping frequency at a preferable gait velocity affected the symmetrisation of stepping time in healthy adults. Greater symmetry of the stepping time was observed both in individuals who had been informed how to react to sounds and in those test participants who had not received any instructions. The clear short-term effect of the RAS on the symmetry of step length was not observed.

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