

BIOMECHANICS OF TEACHING FOR HIP PULLOVER EXERCISE IN PHYSICAL EDUCATION CLASS

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ABSTRACT

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The purposes of this study are 1) to make the special apparatus for hip pullover exercise in physical education, 2) to assess the effect of instruction using this special apparatus.

The special apparatus, called SAKA-AGARI Unit (in Japanese), consists of three conditions for practice: circular arch, trampoline and board, respectively. Children who have few experiences of inverse position and are scared of horizontal bar exercise can easily practice in this apparatus. SAKA-AGARI Unit, which is different from traditional supporting apparatus, has strain gauges attached on the bar. Using this attachment, it is possible to quantify (through electrical outputs) the force exerted on the bar along both the horizontal and vertical direction.

Eight elementary children were tested through the physical education class using SAKA-AGARI Unit, 20 min in a day, 3 times/week, for 2 weeks. EMG, kinetic and kinematic data were obtained during hip pullover exercise pre, during and post class. EMG of the non-acquired children changed, especially the latissimus dorsi and rectus abdominis muscle activities were more effective through physical education class. About kinetic data, the exerted force on the bar in vertical condition increased significantly through class ($p < 0.05$, 0.96, 0.74, 1.32 Kg/w, respectively). Moreover, the ground reaction force in vertical direction also increased significantly ($p < 0.05$, 1.27, 2.30, 2.37 Kg/w). As for the kinematic data, locus of CG moved directly to the bar. And also, the knee velocity of up-swinging leg increased through class from 3.4 m/sec to 4.0 m/sec. About the effectiveness and efficiency of instruction, the value of accomplishment rate for the non-acquired was 75.0%, significantly higher than the traditional technique ($p < 0.05$) and the average days for acquiring hip pullover skill were 3.6 days, shorter than previous studies.

To obtain more practical data, the instruction using SAKA-AGARI Unit for longer period was given to the children who were obese and scared of the inverse position. As a result, children with disadvantages such as obesity and mental uneasiness can not easily acquire the skill of hip pullover, but the improvement for hip pullover movement was observed through instruction.

In SAKA-AGARI Unit, the exerted force on the bar in circular arch condition was half as much as board condition. The increase of knee-velocity for up-swinging leg may depend on the elasticity of trampoline bed. It is suggested that the SAKA-AGARI Unit is the effective apparatus' for decreasing gravitational force and makes the elementary children practice during hip pullover exercise much fun.