THE MODIFICATION OF PEDALING SKILL WITH REAL-TIME REPRESENTATION OF PEDALING FORCE IN NON-CYCLISTS

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INTRODUCTION

By the instruction of the pedaling skill as which the cyclist (athlete) is given traditionally, even non-cyclists can easily modify the pattern of the pedal force during bicycle exercise. The effect of such instruction will vary among individuals in both aspect of the movement and the energy consumption. We examined the effect of modification on the pedaling mechanics induced by the real-time representation of the force-pattern applied to the pedals during bicycling in non-cyclists. Also the modified force pattern was examined in relation to the energy consumption.

METHODS

Eleven males (23-33yrs) participated in a maximal Vo_2 test, control test, and "with instruction" test.
In **the control test,** the subjects pedaled naturally without any instruction using a bicycle ergometer. They pedaled the loads of 30, 50 and 70% Vo_2max, (each load) for 5min at a cadence of 70 rpm.
The pedaling forces of tangential (F_{tan}) and radial (F_{radial}) directions to the crank arm were measured by the strain-gauge method. The resultant force (F_{result}) was determined from F_{tan} and F_{radial}. Each pedal force was averaged on thirty revolutions of the crank. The Vo_2 was averaged on the last 30sec of each exercise bout. The gross mechanical efficiency was calculated from oxygen consumption and mechanical work.
Before **the "with instruction" test,** the subjects were given an explanation of the mechanisms of F_{tan} and F_{result}. During the test exercise, the visual instructions show the subjects the PC monitor displaying F_{result} and F_{tan} on the clock diagram every 30 degrees of crank cycle. After at least 5 min practice periods, the subjects were asked to try the following oral instruction, **"pedal as you make the pedal force exerted tangentially with watching the clock diagram on the PC display (especially in a push phase 90-180 degrees and a pull phase 180-360 degrees on both pedals)"**. The oral instruction was given if necessary.

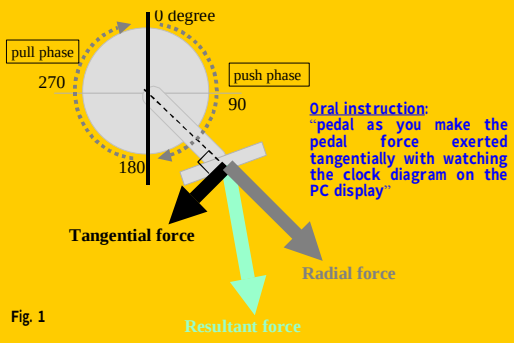

Fig. 1

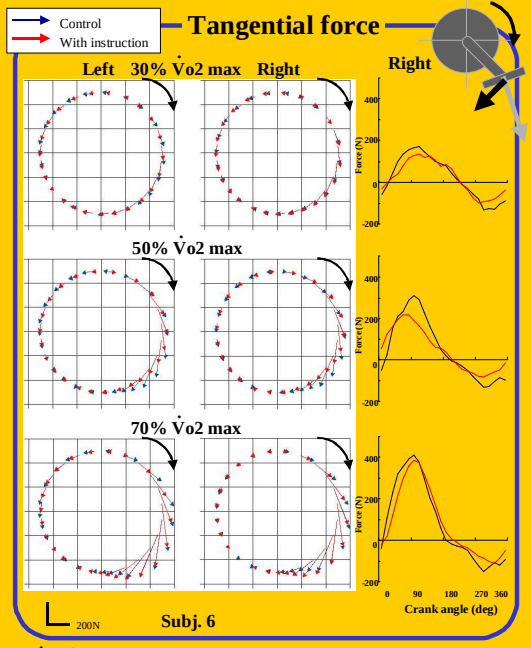

Fig. 2

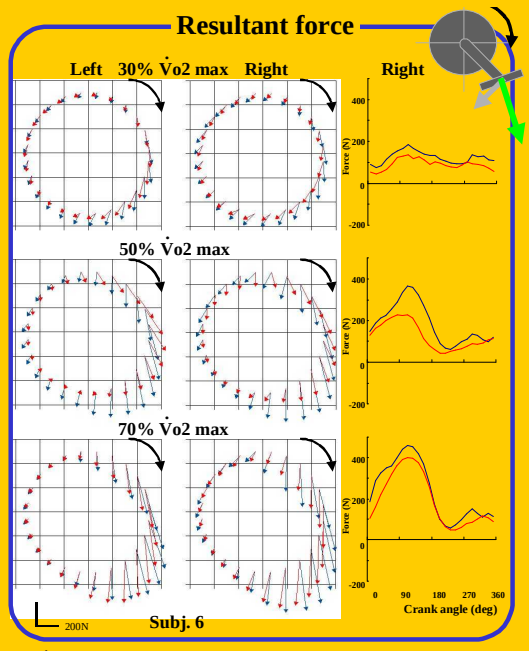

Fig. 3

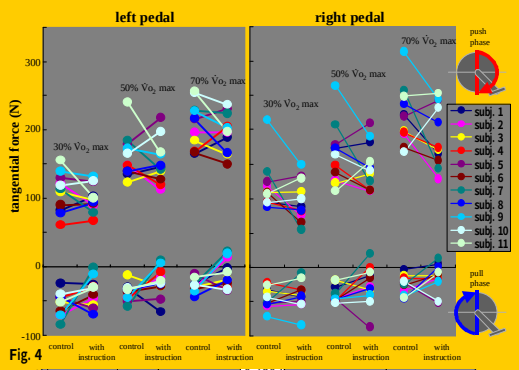

Fig. 4

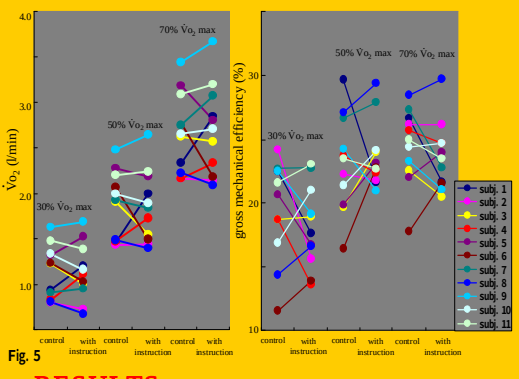

Fig. 5

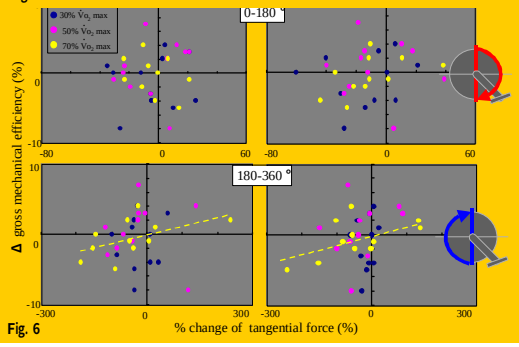

Fig. 6

RESULTS

In the modification of the pedaling mechanics with the feedback instruction, the F_{tan} generally increased in the pull phase (180-360 degree of crank angle) and thus decreased in the push phase (0-180 degree) with the modification of F_{result} indicating the change of direction of pedaling force (Fig 2-4).

Individual difference and asymmetric change in left and right sides was observed in the pattern of F_{tan} (Fig 4). In subject No 2, 7, 9, F_{tan} of left side showed a large increase in the pull phase compared to the right side. And the right F_{tan} of the push phase showed a large decrease compared to the left side.

Although the mechanical efficiency for the control test was improved with increasing the exercise intensity (Fig 5), the modification of F_{tan} or F_{result} did not always improve the mechanical efficiency (Fig 6). Especially in the load of 70%Vo_2max, the excessive change of the F_{tan} made the mechanical efficiency decrease (yellow lines in Fig 6).

CONCLUSION

The effect of the modification on the pedaling skill should be evaluated in the relationship between movement and energy consumption, and individual differences should also be taken into account.