COULD PLANTAR LOAD DISTRIBUTION BE ONE OF THE DETERMINANT FACTORS FOR VERTICAL JUMP PERFORMANCE?

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INTRODUCTION

Plantar pressure/load has been used in many clinical and biomechanical fields [1]. Until now plantar pressure/load generating gives much information for disorder prevention as to analysis impact in contact phase in human movement. However, it is not applied to evaluation of sports skill performance. J. James, et al.,(1993) reported that vertical jump performance could not be explained by many temporal and kinetic variables [2]. The purpose of this study were to investigate whether plantar load distribution during take-off phase influence vertical jump performance.

METHODS

In order to define sub-areas from foot anatomical measurement points, Foot scan (RsScan international, Balance 2nd Generation 7.7, 0.5m plate, with 4096 resistive sensors, 200Hz : Belgium), Vicon MX20Camera×8(Oxford Metric Ltd. 200Hz) and Force plate (Kistler type9287C 0.6m×0.9m, 1kHz: Switzerland) were systematically synchronized as to acquire respective data (Fig.1). Each foot sub-area was determined by using the methods of J.A.Stebbins,et al.,(2005) [3] consisted of including 5 sub-areas(MF: medial forefoot, LF: lateral forefoot, MiF: midfoot, MH: medial heel, LH: lateral heel). Plantar load matrix data were exported every 5ms into each worksheet. Thirty two male subjects performed counter movement jumps on pressure plate and force plate. Jump height was calculated from force plate data. Subjects were divided into Good and Poor groups (Good: n=8, Age21.4±2.4yrs, BH:173.9±4.6cm, BW:71.8±5.3kg, Poor: n=7, Age23.0±3.5yrs, BH:±172.8±3.4cm, BW:72.6±5.0kg) according to performance (Jump height: Poor < mean and ±0.5SD. < Good ). Total plantar load impulses (N sec) and respective weighing normalize time (%) were calculated and compared between Good and Poor jumpers. All statistics analysis were using student's t-test (welch) performed on selected means to detect significant differences (effective p<0.05) between Good and Poor jumper (JMP ver . 8.0, SAS inc.). The comparison of variables to jump height were used by Pearson’s correlation coefficients (effective p<0.05).

RESULTS AND DISCUSSION

During take-off phase, plantar load distribution pattern shifted from Heel to LF and MF. The differences of in duration of the weighing phase time (sec) and normalized time (%) were not observed between two groups. Good jumper exhibited larger total plantar load impulse and MF plantar load impulse compared to Poor jumpers (Total impulse: 0.70±0.18 VS. 0.53±0.03N • sec/BW, p<0.05, MF impulse: 0.36±0.04 VS. 0.24±0.05 N • sec/BW, p<0.001). As for the shift timing of weighing from LF to MF, Good jumpers indicated early in comparison with Poor jumper (42.5±9.1 V.S. 65.8±11.8%, p<0.001, Fig.2). It is indicated Good jumper change early plantar load shift from LF to MF in almost squating position in take-off phase. Jump heights were significantly correlated with lateral-medial change shift time and MF impulse (r = -0.65 and r =0.75, respectively p<0.05).

CONCLUSIONS

It was indicated that MF impulse largely influenced the vertical jump performance, which might be accommodated by the fast plantar load shift from LF to MF. The results of this study suggest plantar load distribution change might be one of key factors as to “Plantar Load Strategy” to assess the skilled jump performance.

REFERENCES