LANDING FORCES PRODUCED IN TAP DANCE

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INTRODUCTION

We performed a retrospective survey among experienced tap dancers that suggested a relatively low injury prevalence and occurrence rate (0.31/1000 exposures) among the surveyed cohort.[1] A literature search revealed no information concerning biomechanical aspects of tap dance. To explain the findings of our injury survey, we hypothesized that tap dance might produce less musculoskeletal stress (forces and/or moments) than other dance and sporting activities and initiated a biomechanical analysis by measuring landing forces in a group of experienced tap performers.

METHODS

Six experienced professional tap dancers (3 male and 3 female, mean age 24.5 ± 10.6 years) were recruited. All subjects were injury-free, actively performing when tested, and signed an informed consent.

Four tap dance sequences (flaps, cramprolls, pullbacks, and a subject-selected virtuoso sequence) were repeated 4-8 times within each condition with both feet on the force platform. Three-D kinematic and kinetic data were acquired with a 5-camera motion analysis system (Vicon, Oxford Metrics Ltd, Oxford UK) at 120 Hz and force platform (AMTI, Advanced Mechanical Medical Technology, Inc., Watertown, MA) at 1080 Hz. A full body marker set, comprised of 39 reflective spherical markers 25 mm in diameter, was used to create an 11-segment model.

Peak amplitude Fx (sagittal plane), Fy (frontal plane) and Fz (vertical plane) forces (N) were calculated for each of the four conditions, and normalized to body weight (BW). Means for each kinetic variable were calculated for each subject to minimize intra-subject variability. Descriptive statistics were then calculated for each condition. Separate between-group (gender) t-tests were calculated for each condition ($p < 0.05$).

RESULTS AND DISCUSSION

Between-group t-tests were not significantly different for any condition, so results for all subjects were merged for analysis. Mean peak Fx and Fy for the six subjects were insignificant (< 1.0 BW) for all conditions. For flaps, Fz ranged from 1.16 to 1.96 BW, (mean 1.46 ± 0.32). For cramprolls, Fz ranged from 1.62 to 3.02 BW, (mean 2.35 ± 0.45). For pullbacks, Fz ranged from 1.55 to 2.88 BW, (mean 2.23 ± 0.47). For the optional or virtuoso steps chosen by each performer (n=5), Fz ranged from 1.70 to 4.19, (mean 2.52 ± 0.99). Mean Fz for all conditions and all subjects was 2.14.

Landing forces have been measured in numerous studies involving walking (1-1.4 BW), running (1.6-3.6), jumping (3.5-6.0 BW), gymnastics (9-14.5 BW), various sports activities (4.0-12.6 BW), aerobic dance (1.5-2.6 BW), and dance jump landings (1.4-2.8 BW). It is apparent that Fz forces occurring during tap dance are in the lower range of those reported for these various activities. Although this finding might appear to confirm our initial hypothesis and explain the apparent decreased injury risk for this dance form, there are additional factors to be considered.

CONCLUSIONS

We conclude that the relatively small Fz forces measured during tap dance among experienced professional performers supports our hypothesis that the apparent lower injury occurrence rate among this group may reflect this finding. Nevertheless, the analysis is highly complex and involves many other factors remaining to be studied.

REFERENCES:

1. Mayers LB et al. *J Dance Med Sci* **7**:121-125, 2003.