

DOES HALLUX DEFORMITY AFFECT THE PLANTAR PRESSURE DISTRIBUTION?

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INTRODUCTION

Hallux valgus (HA) affects many adults, especially athletes and girls of ages 13 and older. The HA affects not only their appearance but also their athletic performance. The repetitive stress on the hallux or metatarsals may induce joint dislocation or subluxation with capsule injury that can result in posttraumatic arthritis. Studies have shown that ballet dancers who bend in demi-pointe place increase stress on the joint [1]. Dancer develops hallux valgus at a younger age than the general population [2]. Plantar pressure pattern has been extensively used for diagnosis of foot disorder. The purpose of this study was to investigate the mechanism of HA among dancers and how it relates to the plantar pressure pattern.

METHODS

29 dancers were recruited for this study. The average age was 20.3±1.8 years old, the average weight was 52.5±7.6 Kgs, and the height was 164.5± 6.8 cm. Radiographs of both feet while weight bearing were taken. The X-ray images were analyzed using OPTIMAS 6.5 (Media Cybernetics USA). HV angles were calculated using previously published methods [3]. For dynamic plantar pressure parameters measurement, the subjects performed barefoot gait analysis on a 10 m-walk way using 110 step/min of normal walking speed. The Footscan 0.5m pressure sensor platform (Rsscan, Belgium) was used for the plantar pressure measurement and data were analyzed by Footscan software 6.3.4.

RESULTS AND DISCUSSION

The values for the HV angles of 58 feet were normally distributed. The mean HV angles for 1, 1~2, and 2 standard deviation or distribution across <68%, 68~95%, and >99% of individuals were 14.8, 25.3, and 29.5 degrees, respectively. These HV angle values shows 76% of subjects were in the normal range but 24% were in the mild to moderately abnormal range based on radiographic measurements for a normal 15° angle,[4], a mild of 20° angle, a moderate of 30° angle, and reaching 40° for severe deformity [5]. The average peak pressure was found to be highest at the heel region where it ranged from 20 to 40 N/cm². The second highest pressure was located at the M2 or M3 region for the normal HV angle subjects. For those who had mild to moderate HV angles the peak pressure was located at the first-second metatarsal head or big toe. The right foot was found to have higher peak pressure than left. The peak plantar pressure in the medial heel region and the second metatarsal head were correlated to mild to moderate HV with *r* values of 0.658 and 0.52, respectively.

CONCLUSIONS

Most of the dance subjects didn't show HV deformity but dancers are subjected to higher peak plantar pressure at the first to second metatarsal head or at the big toe. The lateral foot region had the smallest peak pressure, which implies that greater impact force was absorbed at the medial heel region during the loading response of the gait cycle. Excessive pronation angles were found at the time of push off.

Abnormal shear force and combined excessive pronated angle during this period could be a reason for the large HV angles developed by dancers. A corrective orthosis should be prescribed for dancers suffering from hallux deformity to prevent the further deformation.

Table 1: The mean peak plantar pressure at different marked region

| Foot | Type | Mean Peak Pressure (N/cm ²) | | | | | | | |
|--------------|-------------|---|-------|-----|-----|------|------|------|------|
| | | Med H | Lat H | M5 | M4 | M3 | M2 | M1 | T1 |
| <u>left</u> | normal | 23 | 20 | 9 | 16 | 21 | 22 | 15 | 16 |
| | mild HV | 36.6 | 38.7 | 0.9 | 4.8 | 9.7 | 13.2 | 21.1 | 7.1 |
| | moderate HV | 33 | 27 | 8 | 9 | 18 | 19 | 15 | 14 |
| <u>right</u> | normal | 24 | 23 | 10 | 14 | 19 | 20 | 14 | 15 |
| | mild HV | 33 | 37 | 6 | 8 | 17 | 13 | 14 | 18 |
| | moderate HV | 36.7 | 40.3 | 3.5 | 9.4 | 14.3 | 13.7 | 11.6 | 25.3 |

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