Introduction: The structure of the foot arch, which acts as a shock attenuator, varies widely from person to person [1]. Different foot types appear to predispose people to certain injuries [2, 3]. Static measurement of the foot posture is most widely used for classification due to its simplicity. If static foot measurement was shown to be predictive of foot motion during activities, clinicians could better understand their patient's foot. However, there is little information regarding the dynamic function of the foot arch or the correlation between static and dynamic measurement. Therefore, the purpose of this study is to determine the sagittal plane motion of the medial and lateral longitudinal arch during landing, as well as to determine the correlation between the range of arch motion assessed in a dynamic versus static condition.

Materials and Methods: Ten healthy male subjects performed single leg landings from a height of 10cm with their knee extended. Subjects were asked to stop and balance after landing. Static X-ray images were obtained in loaded (single leg standing) and no load conditions. Each trial was recorded using cineangiography (INTEGRIS BH5000R.1 PHILIPS). Images were obtained at a rate of 60Hz (radiation exposure: 200mA 1msec, intensity: 50kV). Simultaneous ground reaction forces (GRF) were measured using a force plate (KISTLER).

Data were analyzed using a template method. Sagittal motion was defined as the change in the angle of the arch between the times of toe contact and maximum arch angle after landing. A paired t-test was performed to determine differences between medial and lateral longitudinal arch. Significance was set at p<0.05. Pearson product-moment correlation coefficients were used to determine the relation between medial and lateral longitudinal arch motion as well as the correlation between static measurement of the loaded and unloaded arch and the dynamic range of arch motion during landing.

Results: The magnitude of the arch angle increased with time for 80-100msec in all subjects. The magnitude of the lateral angular change was significantly larger than that of medial (Fig 1). Regarding translational motion, motion of the medial longitudinal arch was significantly larger than that of the lateral arch (Fig 2). The Pearson product-moment correlation coefficient for the magnitude of the dynamic motion of the medial arch motion in relation to that of the lateral arch was r=0.83 (r2=0.69). The correlation strengths for the range of dynamic motion of the medial arch compared to the no-load and loaded states as well as the difference between the no-load and loaded states were slight. The Pearson product-moment correlation coefficient for the range of dynamic motion of the lateral arch compared to the no-load and loaded state as well as the difference between the no-load and loaded states were r=0.68 (r2=0.47), r=0.56 (r2=0.31) and r=0.79 (r2=0.62).

Discussion: The most important finding of this study was that each longitudinal arch has a different deformation pattern (Fig.3). This result indicates that each longitudinal arch has a different function. The correlation strengths between the static and dynamic conditions of the medial longitudinal arch were slight. On the other hand, the correlation strengths between the static and dynamic conditions of the lateral longitudinal arch were more than moderate. A possible reason is that the medial arch has a complex motion during landing which is not only an angular change but also a translational motion. These results indicate that the static measurement obtained x-ray image is not predictive of the range of medial arch motion. However, static measurement might be predictive of the range of lateral arch motion during landing.