THE BIOMECHANICAL EFFECTS OF INSOLE FOR PES CAVUS

L.R Chen¹,², K.H. Chen,³,⁴ and S.W. Yang⁵
¹Department of Rehabilitation Medicine, Mackay Memorial Hospital, Taipei;
²Institute of Rehabilitation Science and Technology, National Yang-Ming University, Taipei;
³Department of Obstetrics and Gynecology, Buddhist Tzu Chi General Hospital, Taipei Branch, Taipei;
⁴College of Public Health, National Taiwan University, Taipei;
⁵Institute of Biomedical Engineering, National Yang-Ming University, Taipei; email: swyang@bme.ym.edu.tw, web: http://rehab.ym.edu.tw/

INTRODUCTION
Pes cavus, also called high-arched foot or cavoid foot, is often obscured by people. It occurs in approximately 15% of the population[1]. The etiologies include idiopathic, neuromuscular, and traumatic diseases[2]. Almost twice the number of painful feet is because of pes cavus than pes planus[3]. This kind of foot absorbs impact force poorly. People with cavoid feet have a greater risk of lower limb athletic injury[4]. Soft molded insoles have been used as an intervention for pes cavus in practice for many years, but few investigations focused on the biomechanical effects of these insoles. This research aimed at the biomechanical changes brought by insoles with medial arch support and rearfoot and forefoot lateral wedges.

METHODS
Thirty young adults with idiopathic pes cavus, whose arch index are below 0.21[5], were recruited. None of them suffered acute foot injuries in the past six weeks or had lower extremity surgeries or trauma. Subjects with inflammatory arthritis, diabetes, neuromuscular disorders, or congenital musculoskeletal defects were also excluded. All participants signed the informed consent.

A standardized protocol of questionnaire and measurement, including characters of foot or lower back discomfort (e.g. pain duration, severity, using VAS, and frequency), foot callus location, tender point distribution, and range of motion of the foot and ankle, is performed by an experienced podiatrist before walking trial. Kinematic and kinetic behavior of lower extremities on three conditions: barefoot, saddles, and saddles with insole, were measured using Novel Pedar-X system, AMTI forceplate, and Vicon motion analyze system. The insole is composed of arch support, made of polypropylene with 2.5-2.9mm arch height, rearfoot and forefoot 8 degree lateral wedges, and upper layer made of EVA with 3mm thickness and shore A 40 degree. The participants were allowed to practice a walk with self-selected, comfortable speed on the boardwalk in a period of 2 minutes. Three trials were recorded for every condition of each subject.

RESULTS AND DISCUSSION
Plantar pressure and pressure-time integrals decreased at the forefoot and rearfoot with insole. The center of gravity projection and ground reaction force patterns trended to normal while using insole. The motion analysis of lower extremities with insole showed more ankle eversion and less tibia internal rotation.

CONCLUSIONS
Insoles with arch support and rearfoot and forefoot lateral wedges can change the biomechanical behaviors of pes cavus toward normal.

REFERENCES