

Effect of Foot Posture and Fatigue on Static Balance and Electromyographic Activity of Selected Lower Limb Muscles in School Children Aged 12 to 14 Years

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Abstract : Objective: Several studies have revealed that flatfoot posture has some effect on altered lower limb muscle function, in comparison to normal foot posture. There were still limited studies to examine the effect of fatigue on flatfoot posture in children. Therefore, this study was aimed to find out jumping fatiguing effect on static balance and to compare lower limb muscle function between flatfoot and normal foot in school children. Methods: Thirty junior high school children aged 12 to 14 years took part in this study. Of these all children, 15 had the normal foot (8 males and 7 females) and 15 had flatfoot (6 males and 9 females). Foot posture was classified based on an arch index of the footprint by a foot scanner which calculated the data using AUTOCAD 2013 software. Surface electromyography (EMG) activity was recorded from tibialis anterior, gastrocnemius medialis, and peroneus longus muscles while those participants were standing on one leg barefoot with opened eyes. All participants completed the entire protocol (pre-fatigue data collection, fatigue protocol, and post fatigue data collection) in a single session. Static balance and electromyographic data were collected before and after a functional fatigue protocol. Results: School children with normal foot had arch index 0.25 ± 0.01 whereas those with flatfoot had 0.36 ± 0.01 . In fact, there were no significant differences for anthropometric characteristics between children with flatfoot and normal foot. This statistical analysis showed that fatigue could influence static balance in flatfoot school children ($p < 0.05$), but not in normal foot school children. Based on electromyographic data, the statistical analysis showed that there were significant differences ($p < 0.05$) of the decreased median frequency on tibialis anterior in flatfoot compared to normal foot school children after fatigue. However, there were no significant differences on the median frequency of gastrocnemius medialis and peroneus longus between both groups. After fatigue, median frequency timing was significantly different ($p < 0.05$) on tibialis anterior in flatfoot compared to normal foot children and tended to appear earlier on tibialis anterior, gastrocnemius medialis and peroneus longus (at 7s, 8s, 9s) in flatfoot compared to normal foot (at 15s, 11s, 12s). Conclusion: Fatigue influenced static balance and tended to appear earlier on selected lower limb muscles while performing static balance in flatfoot school children. After fatigue, tremor (median frequency decreased) showed more significant differences on tibialis anterior in flatfoot rather than in normal foot school children.

Keywords : fatigue, foot postures, median frequency, static balance

Conference Title : ICSM 2015 : International Conference on Sports Medicine

Conference Location : Bali, Indonesia

Conference Dates : October 11-12, 2015