소아재활
발표일시 및 장소 : **10 월 27 일(토) 10:10-10:20 Room E(5F)**

OP4-1-2

Factors associated with unaffected foot deformity in hemiplegic cerebral palsy

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Objectives
The aim of this study is to (1) assess the foot angular components of affected foot associated with valgum deformity of unaffected foot and to (2) re-define the actual leg-length inequality in hemiplegic cerebral palsy (CP).

Methods
We retrospectively reviewed the medical record and radiologic images of 110 hemiplegic cerebral palsies. The inclusion criteria were: 1) hemiplegic CP without upper motor neuron sign of unaffected side; 2) who can walk independently without walking aid. Exclusion criteria were: 1) age <5 years at the time of evaluation; 2) who had botulinium toxin injection within 6 months; 3) who had surgical treatment of either limb. Weight bearing plain radiography of bilateral foot was obtained from each subject. Angular measurement focused on collapse of the longitudinal arch, hind foot valgus, forefoot abduction. Valgus deformity of unaffected side was defined if the anteroposterior talocalcaneal angle (TCA) excess 30 degrees or lateral TCA excess 45 degrees. Leg length discrepancy (LLD) and pelvic tilting angle was measured.

Results
Among 76 patients, 40 (52%) patients had valgus deformity of unaffected side. There were no significant differences of age, affected side, deformity type of affected side, and application of bilateral biomechanical foot orthosis (BFO) between patients with or without valgus deformity of unaffected side. (Table 1) Numbers of patients incapable of voluntary ankle extension above neutral at affected side, LLD and lateral TCA were significantly increased in patients with valgus deformity. (Table 1,2,3) Lateral foot alignment angles focused on collapse of the longitudinal arch and hind foot valgus were significantly correlated between both feet. (Table 4) The optimal cutoff point of to predict valgum deformity was LLD over 10 mm or affected limb/unaffected limb length index below 0.98. (Table 5)(Figure 1) Discussion The factors inducing the coping mechanism of uninvolved foot is still not defined. In addition to several studies focused on gait analysis using kinematic features of uninvolved limb, all information available on both views in making assessment of foot alignment is necessary. Only effect of amount of correction by heel lift on gait symmetry cannot predict the progress of unaffected foot

deformity. Among various foot alignment angles, only hind foot valgus angle of affected side was associated with valgum deformity of unaffected foot. In addition, as children with hemiplegia can develop a leg length discrepancy that becomes more significant as they grow, cut off values of limb length discrepancy should be important index to predict valgus deformity of unaffected foot.

Conclusion

This was the first study focused on angular assessment associated with valgum deformity of unaffected foot in hemiplegia CP. Clinicians should also pay close attention to the unaffected foot deformity by overall associated factors including foot deformity of affected side and bilateral limb length ratio.

Table 2. Leg length asymmetry associated with valgus deformity of unaffected foot

Variables		With valgus deformity (N= 40)	Without valgus deformity (N= 36)	Total (N= 76)	*p* -value
Clinical LLD (%)	Yes	2 (5.56)	0 (0.00)	2 (2.63)	0.221
	No	40 (94.44)	34 (100)	74 (97.37)	
LLD (mean (SD))		1.67 (7.99)	3.63 (7.42)	52 (68.42) 24 (31.58)	0.024*
Pelvic tilting (mm) (mean (sd))		29 (72.50)	14 (38.89)	43 (56.58)	0.051

N, Number; SD, Standard Deviation; LLD, Leg length discrepancy
*$p < 0.05$

Table 3. Foot alignment of affected side associated with valgus deformity of unaffected foot

Variables	With valgus deformity (N= 40)	Without valgus deformity (N= 36)	Total (N= 76)	*p* -value
TMA Lat (degrees), (mean (SD))	14.77 (11.42)	11.52 (7.25)	13.23 (9.75)	0.148
Calcaneal Pitch (degrees), (mean (SD))	14.1 (5.61)	11.96 (5.29)	13.08 (5.53)	0.092
TNA (degrees), (mean (SD))	16.61 (9.64)	12.56 (8.78)	14.67 (9.40)	0.062
TMA AP (degrees), (mean (SD))	13.29 (9.06)	10.13 (9.29)	11.77 (9.24)	0.141
TCA AP (degrees), (mean (SD))	26.66 (8.76)	23.45 (7.30)	25.12 (8.20)	0.091
TCA Lat (degrees), (mean (SD))	46.33 (8.63)	38.26 (11.03)	42.51 (10.58)	0.001*

N, Number; SD, Standard Deviation; TMA Lat, Lat 1st metatarsal talar angle; TNA, Talonavicular coverage angle; TMA AP, 1st metatarsal talar angle at anteroposterior view; TCA AP, Talocalcaneal angle at anteroposterior view; TCA Lat, Talocalcaneal angle at lateral view
*$p < 0.05$

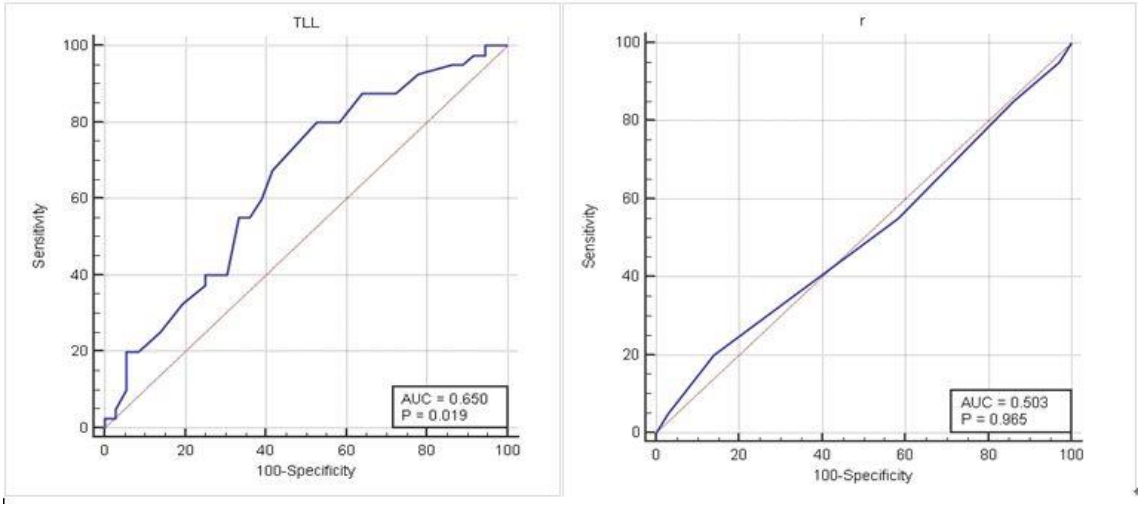

Figure 1. AUC of the ROC curve of LLD and affected/unaffected limb length index to predict valgus deformity of unaffected foot.