Long-Term Result of Clubfoot Release by Gait Analysis.
Foot and Ankle Motion Study

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Introduction: Talipes Equinovarus (clubfoot) is a common congenital orthopaedic condition. Treatment includes manipulation, serial casting and surgery. Morphological evaluation does not always correlate with functional capacity and treatment outcome over a long-term follow-up. Other studies suggest suggest that gastrocsoleus strength is key to a good functional outcome. The goal of this study is work is to evaluate surgical releases in children with clubfeet with a long-term follow-up using the International Clubfoot Study Group (ICFSG) Outcome Evaluation, American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot and forefoot scales, and quantitative gait analysis.

Statement of Clinical Significance: Long-term follow-up is necessary to measure the efficacy of congenital clubfoot management.

Methodology: There were 17 patients who had a soft tissue release by one surgeon between July 1985 and June 1987 who were available for evaluation and gait analysis. Average age at surgery was 8 months. Average follow-up is 15.8 years from the initial surgery. All patients had ICFSG outcome evaluations (60 point system) addressing morphology, functional evaluation and radiograph evaluation. AOFAS hindfoot and forefoot scales were used in every patient, (100 point scale). Standing radiographs were taken and included ankle AP view, foot AP, and foot lateral views during standing position. A foot tracing was made to determine the bimalleolar angle for measurement of ankle rotation. Gait analysis was performed using a Vicon Motion System. Milwaukee foot and ankle motion analysis studies were performed on all patients.

Results: There were 2 female and 15 male patients. Eight patients had bilateral surgical releases, nine patients had unilateral procedures with a total of 25 operated feet. Among those who had one foot operated, 3 had bilateral deformity with the other foot treated non-surgically. ICFSG evaluation revealed 17 excellent feet, 6 good and 2 fair. AOFAS hindfoot evaluation revealed 9 feet over 90 points, 9 feet between 81 and 90 points and 7 feet between 71 and 80 points. AOFAS midfoot evaluation revealed 10 feet over 90 points, 10 feet between 21 and 90 points, 4 feet between 71 and 80 points, and 1 foot below 70 points. The bimalleolar angle adjustment in lateral radiographical measurement showed significant change in the apparent shape of the dome of talus.

Patients were divided into four groups for statistical analysis of gait data. The patient groups included: all surgical releases (bilateral and unilateral operated feet) n=25 feet, all non-operated clubfeet n=9 feet; non-operated normal feet n=6 feet; and non-operated clubfeet n=3 feet. There were no significant differences in temporal or spatial parameters among the four groups ($p<0.05$). Kinematic parameters in the sagittal plane were not significantly different

among the four groups. Kinematic evaluation confirmed that dynamic ankle range utilized during ambulation is only a fraction of that available per clinical (ROM) testing. There is decreased plantar flexion which may indicate weakness of Achilles tendon. Significant internal foot progression angle is also present in the operated feet. Significant differences were noted in ankle peak power generation between the following groups: unilateral operated vs. unilateral non-operated, normal non-operated vs. unilateral operated, and all operated vs. non-operated patients (Table I).

Table I. Kinetic Parameters: p values

Treatment Groups	Hip Peak Ext	Knee Peak extension	Ankle Peak Power Generation	Ankle Work
Unilateral operated vs. unilateral non-operated	0.714	0.097	0.000*	0.357
Non-operated clubfeet vs. unilateral operated	0.926	0.130	0.706	0.856
Normal non-operated vs. unilateral operated	0.790	0.110	0.000*	0.247
All operated vs. all non-operated	0.626	0.235	0.001*	0.103

*$p<0.05$

Discussion: The most important factor associated with long-term results of clubfoot surgery appears to be a function of gastroc-soleus strength. Patients function well with decreased ankle range of motion and do not fully use their available range of motion during gait. The ICFSG is an appropriate tool to evaluate the outcome of clubfoot treatment in aspects including morphology, functional outcome and radiographic appearance. Gait analysis adds valuable information on dynamic ankle range of motion and power. A small number of non-operated clubfeet had similar gait characteristics to the operated feet.

References:

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