

## Validity and Reliability of Spatio-Temporal Gait Parameters in Adolescents

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Gait is a complex activity based on information captured by periphery receptors and elaborated at the level of central nervous system. The age of 6 years seems to constitute a turning point in locomotor control<sup>[1]</sup>. From about 7-8 years of life no difference to the adult pattern could be observed<sup>[2]</sup>, even if recent studies have implied that gait maturation may continue beyond the age of 8 years and may not be complete until 13 years of age<sup>[3,4]</sup>. The dynamic baropodometry is used to evaluate adolescent gait in cerebral palsy, idiopathic scoliosis, hip arthrodesis and anatomical alterations of plantar foot<sup>[5,6]</sup>.

The purpose of this study was to recruit twenty-two healthy asymptomatic adolescents (14 boys mean age 13.6±1.6; 8 girls, mean age 12.8±1.2) to determine the reliability in assessing spatiotemporal measurements frequently used in clinical practice.

During a 4 months period, at Department of Orthodontics, University of Palermo, we analysed 22 healthy subjects without orthopaedic, neurological and/or musculo-skeletal problems who needed orthodontic treatment. Written informed consent to participate in the study was obtained. The subjects were tested with an electronic baropodometer (Milletrix System® Roma, Italy) twice at an interval of one week by one clinician to determine test-retest reliability and twice at the same day by two clinicians to determine inter-rater reliability. The test-retest measures of reliability demonstrated moderate-to-good within-session, ranging from 0.62 to 0.99. Very reliable were cadence (left foot ICC=0,92, 95% CI=0,32 to 0,89, right foot ICC=0,95, 95% CI=0,74- 0,94) and total surface (left foot ICC=0,96, 95% CI=0,82-0,97, right foot ICC=0,91, 95% CI=0,89-0,92).

The measures of inter-rater reliability demonstrated moderate-to-good levels of reliability, ranging between 0.62 and 0.97. Very reliable were the cadence (left foot ICC= 0.95, 95%

CI=0.37 to 0.90, right foot ICC=0.92, 95% CI =0.79-0.97) and walking speed (left foot ICC=0.90, 95% CI=0.69 to 0.57, right foot ICC= 0.91, 95% CI=0.78 to 0.96). The assessment of gait is essentially clinical (physical musculoskeletal and neurological examinations).

Information elicited from dynamic baropodometry can be an integral component in the formulation of patient's clinical diagnosis and intervention plans, allowing to investigate the plantar morphology and the distribution of the pressures exerted on the foot plant during gait with its pathological variations and may be helpful in developing and monitoring rehabilitation programs.

The study of the distribution of spatio-temporal parameters during the walking cycle in adolescents can be useful to build orthotic devices, for evaluating surgical techniques (correction of hallux valgus, ankle's peripheral nerves decompression), physical therapeutic intervention's outcome, and plantar sensitivity<sup>[7,8]</sup> as well as for studying several gait disorders<sup>[9]</sup>. For this reason it is necessary to ensure that measurement systems, can accurately capture and reproduce parameters of dynamic foot function on different occasions.

We believe that the electronic baropodometer is a minimally invasive methodology with moderate-good reliability useful for monitoring baropodometric variables in normal adolescent population. We recommend future studies in order to investigate the reliability of baropodometric measurements in a younger group of patients, and to study the influence of puberty and adolescence upon posture.

**Key words:** Baropodometry; Reliability; Plantar pressure; Gait

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## Netherton Syndrome, a Case Report and Review of Literature

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Netherton Syndrome (NS) is a rare hereditary autosomal recessive multisystem disorder which presents with generalized erythroderma at birth or soon after<sup>[1]</sup>. Its incidence is estimated to be 1/200,000<sup>[2]</sup>. NS presents in most (but not all) patients with generalized erythroderma and scaling resembling congenital ichthyosiform erythroderma, or continuous peeling of the skin<sup>[3]</sup>. Other common features of the disease are enteropathy, hypoalbuminemia, aminoaciduria, mental retardation, growth retardation, and immunologic abnormalities<sup>[4]</sup>. NS presents almost

with a specific hair shaft abnormality known as "bamboo hair"<sup>[5]</sup>. The third characteristic feature of NS is an imbalance of the immune system. Serum level of IgE is markedly elevated<sup>[6]</sup>. Treatment is symptomatic such as topical emollients, keratolytics, tretinoin and corticosteroids, alone or in combination. PUVA therapy has produced variable results<sup>[7]</sup>. We present a case of NS with a positive familial history, admitted due to failure to thrive and erythroderma and severe diarrhea. The diagnosis was based on clinical as well as histological findings.

A 63-day-old boy, born premature at 1850 g to non consanguineous parents was admitted due to severe failure to thrive and diarrhea and generalized erythroderma and scaling. There was a history of one missed conception and previous child who succumbed to death at seventh month due to ichthyosiform disease and recurrent infection without any specific diagnosis. The weight gain was only 200 grams in 2 months. He was irritable and the skin examination showed generalized erythroderma covered by fine, translucent scales on extremities and scalp. This case was examined with colonoscopy and active colitis was diagnosed. Blood culture was positive for *staphylococcus aureus*. His hair fall was significant at admission (Fig. 1). The typical characteristic of bamboo hair was determined (Fig. 2). The laboratory findings during hospitalization showed mild hypernatremia (serum sodium=150), direct hyperbilirubinemia (Total bilirubin=9, direct bilirubin=6.2), elevated hepatic enzymes (aspartate aminotransferase =140, alanine aminotransferase=54), hypothyroidism (thyroid stimulating hormone =13, thyroxine=7) and C-Reactive protein=4+. He did not tolerate breast milk; therefore we started a specific hypoallergenic formula (Neutramigen) parallel with parenteral nutrition. Unfortunately, he succumbed to death a month later due to infection. His irritability might be related to universal pruritis whereas generalized sweeping with paraffin relieved this symptom. Sepsis was diagnosed by positive blood culture for *Staphylococcus aureus*. His antibody screen was almost normal except for IgE level which was slightly elevated (IgE=7.6 mg/dl). Our patients had sparse, brittle and markedly thin hair alongside trichorrhexis nodosa (bamboo hair). Typically,

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