

# Integration of the Plantar Grasp Reflex as an Indicator of Ambulation Potential in Developmentally Disabled Infants

SUSAN K. EFFGEN

The integration or lack of integration of the plantar grasp reflex, as tested in supported standing, was investigated in 26 developmentally disabled infants and was related to the attainment of independent ambulation without assistive devices. All infants who displayed integration of the plantar grasp reflex later developed independent ambulation. Thirteen infants did not display integration of the reflex during three to five years of follow-up. Of those 13 infants, only 1 achieved independent ambulation. This preliminary clinical investigation provides evidence of the prognostic value of the presence or absence of the plantar grasp reflex as an indicator of ambulation potential in developmentally disabled infants.

**Key Words:** *Child developmental deviations, Plantar grasp reflex, Prognostic indicator, Gait.*

Normal infants display a plantar (or foot) grasp reflex for about the first 9 months of life.<sup>1,2</sup> Normal infants also learn to walk independently by the age of about 11 to 15 months, after the integration of the plantar grasp reflex.<sup>1-3</sup> (Integration is inhibition of the reflex in normal, unstressful situations.) In infants with developmental disabilities, the plantar grasp reflex is frequently seen for longer than the first 9 months of life, and may be present indefinitely.<sup>1</sup> The purpose of this preliminary study was to determine at what age the plantar grasp reflex does integrate in developmentally disabled infants, and to relate that age to the age of attainment of independent ambulation. The prognostic outlook for independent ambulation of those children who did not display integration of the plantar grasp reflex was also investigated. Such information is vital to therapists in counseling parents, developing long- and short-term objectives, planning treatment for the children, and evaluating the effectiveness of treatment programs. If the infant displays the plantar grasp reflex when evaluated, integrates it before treatment starts, then ambulates independently several months later, few conclusions can be drawn about effectiveness of a treatment program. Because independent ambulation was expected, it is impossible to determine if treatment hindered or facilitated the date or quality of ambulation.

The study of data concerning the plantar grasp reflex is complicated by the use of various testing

methods and the frequent confusion of the plantar grasp reflex with the Babinski's reflex<sup>4</sup> or the clawing reactions seen in early walkers with immature balancing reactions.<sup>5</sup>

Milani-Comparetti and Gidoni test for the presence of the plantar grasp reflex by placing the child in a supported standing posture, stimulating the soles of the feet by floor contact, and observing for plantar flexion of the toes.<sup>1</sup> They believe when the plantar grasp reflex is tested in this functional standing position "it must disappear before the child is able to stand with support."

Peiper,<sup>4</sup> Touwen,<sup>2</sup> and Beintema<sup>6</sup> test for the presence of the plantar grasp reflex by placing the child in a supine position while the tester presses his thumb against the sole of the child's foot just below the toes and observes for flexion of all five toes. When using this testing method, Touwen found "no clear relationship between a disappearance of the plantar grasp and the onset of walking unsupported" in normal infants.<sup>2</sup> He also found the natural course of the development of the plantar grasp reflex to be quite variable. The variability of the plantar grasp reflex when tested with the patient in a supine position limits the potential importance of this reflex in terms of prognosis. Therefore, the plantar grasp reflex should be tested in the more reliable and functional supported standing position. The intent of this preliminary investigation is to demonstrate that when tested for appropriately, there is a relationship between the integration of the plantar grasp reflex and the onset of independent ambulation in developmentally disabled infants.

Mrs. Effgen is Assistant Professor, Department of Physical Therapy, College of Allied Health Sciences, Georgia State University, Atlanta, GA 30303 (USA).

This article was submitted January 14, 1981, and accepted July 10, 1981.

**TABLE 1**

*Summary of Diagnoses and Ages of Attaining Observed Behaviors of Those Who Integrated Plantar Grasp Reflex and Achieved Independent Ambulation*

Diagnosis	Age (mo)			
	First Seen	Plantar Grasp Reflex Integrated	Pull-to-Stand	Independent Ambulation
Pierre Robin syndrome and hypotonia	6.0	9.0	19.0	22.0
Down syndrome	9.5	16.0	9.5	16.0
Down syndrome	3.0	23.0	23.0	28.0
Down syndrome	3.0	10.0	15.0	23.0
Birth trauma	7.0	11.0	12.0	19.0
Birth trauma	2.0	18.0	11.0	23.0
Prematurity and hydrocephalus	4.0	10.0	12.0	16.0
Down syndrome and prematurity	2.0	8.0	12.5	24.0
Down syndrome	8.0	11.5	20.5	26.0
Hemiplegia	8.0	10.0	18.0	22.0
Down syndrome	1.0	21.0	21.0	30.0
Down syndrome	2.0	12.0	20.0	27.0
Down syndrome	2.5	8.0	12.0	20.5

**METHOD**

Subjects were children being cared for through an infant program that provided medical, educational, psychological, social, physical therapy, and occupational therapy services in the form of home-treatment programs and at least monthly follow-ups. Some of these children were also enrolled in day-care facilities. The group comprised 15 boys and 11 girls. Their average age when first seen was 6.1 months, with a standard deviation of 4.3 months. All children displayed a bilateral plantar grasp reflex when first tested and were motorically delayed as tested on the Milani-Comparetti Motor Development Screening Test<sup>1</sup> and the Denver Developmental Screening Test.<sup>7</sup>

The subjects selected had a variety of developmental disabilities, excluding spinal cord injuries because they affect innervation of the lower limbs (Tabs. 1 and 2). I recognize the limitations of using a heterogeneous population, but because this was a preliminary study in an area of little previous research, I believed the heterogeneous diagnoses and the homogeneity of developmental delay would provide much needed data.

**TABLE 2**

*Summary of Diagnoses and Ages First Seen of Those Who Did Not Have Integration of the Plantar Grasp Reflex*

Diagnosis	Age First Seen (mo)
Spastic quadriplegia	10.0
Birth trauma	15.5
Rubinstein-Taybi syndrome	15.0
Anglemann's syndrome (Happy Puppet syndrome)	8.0
Duchenne muscular dystrophy	3.0
Cytomegalovirus	5.0
Prematurity	10.0
Multiple abnormalities	16.5
Down syndrome	6.0
Spastic quadriplegia	8.0
Spastic quadriplegia	10.0
Cerebral palsy	2.5
Mental retardation <sup>a</sup> and numerous dysmorphoses	7.0

<sup>a</sup> Did not integrate the plantar grasp reflex but did achieve independent ambulation at age 25 months.

For the investigation, I used Milani-Comparetti and Gidoni's<sup>1</sup> functional supported standing testing method. A physical therapist or occupational therapist lowered the child to the floor slowly, and provided as much support as was needed for the child to maintain a weight-bearing position on the entire plantar surfaces of both bare feet. The supporting surface was a small woven carpet on the floor. The supporting therapist and a second one observed for the response of initial, bilateral toe flexion. The response, to be positive, had to be bilateral but did not need to be sustained. This positive response, if judged according to the Beintema (Prechtl) scoring scale,<sup>6</sup> would receive a score of 3 or above, indicating at least a good, but short, response. No distinction was made between a nonsustained (less than 10 seconds) and a sustained (greater than 10 seconds) response. Presence of the plantar grasp reflex was determined by two consecutive positive bilateral responses, or three positive bilateral responses in five trials. After the trials, the therapists compared results. If there was not complete agreement, the testing procedure was repeated several minutes later. The procedure never needed to be repeated more than once.

Independent ambulation was defined as walking barefooted without support or any assistive devices for 3.1 m (10 ft). During ambulation, encouragement and repetition were allowed to obtain the best re-

sponse. The children were tested at least monthly until they walked independently or from 3 to 5 years if they did not achieve independent ambulation.

## RESULTS

Thirteen children demonstrated integration of their plantar grasp reflex while under care and later all achieved independent ambulation, indicating a 100 percent prediction was correct (Tab. 1). Thirteen children did not display integration of their plantar grasp reflex. Of those 13, 12 (92%) did not walk independently during the three- to five-year follow-up period (Tab. 2). A chi-square test of independence with one degree of freedom yielded a value of 22.29 ( $p < .005$ ). This supports the conclusion that there is a significant relationship between the integration of the plantar grasp reflex and the ability to achieve independent ambulation.

The mean age of integration of the plantar grasp reflex was 13.29 months with a standard deviation of 4.97 months. The mean age for attainment of independent ambulation in those who displayed integration of the plantar grasp reflex was 22.81 months with a standard deviation of 4.30 months. The mean length of time from integration of the plantar grasp reflex to independent ambulation was 9.92 months with a standard deviation of 4.83 months.

## DISCUSSION

The finding that 100 percent of the developmentally disabled children who displayed integration of the plantar grasp reflex later achieved independent ambulation is of significant value to the clinician. The integration of the plantar grasp reflex, as tested in a supported weight-bearing position, can serve as an excellent prognostic indicator of ambulation potential. Additionally (with the exception of one child), the results of this study agree with Milani-Comparetti and Gidoni in that the children were unable to achieve independent ambulation when the plantar grasp reflex, as tested in standing, was present.<sup>1</sup> A portion of the results disagree with Milani-Comparetti and Gidoni, because 20 percent of my subjects were able to pull-to-standing and stand at a support

when plantar grasp reflex was still present. Apparently, the plantar grasp reflex may be present in developmentally disabled infants who stand with support, but it must be integrated before a significant majority of the children can walk independently without assistive devices. The presence of the reflex beyond the normal period of time is, therefore, not a good prognostic sign and its integration is necessary before total independent ambulation can be expected in the near future. The data is insufficient to answer the question of when, after integration occurs, to expect independent ambulation in a child with a particular developmental disability.

The effects of treatment on facilitating integration of the plantar grasp reflex also are unknown. The children in this study were involved in an intervention program and there is no way to analyze the effect of the program on the integration of plantar grasp reflex or on the attainment and quality of independent ambulation. Serious consideration should be given, however, to the possibility that once integration occurs, independent ambulation is inevitable and intensive intervention efforts may have no positive effect upon the final outcome. Conversely, intervention might facilitate walking and improve the quality of the gait pattern.

## CONCLUSIONS

My results demonstrated that all children with integration of the plantar grasp reflex later ambulated independently; 92 percent of the children who did not have integration of the reflex did not achieve independent ambulation during a three- to five-year follow-up. I believe the prognostic value of this reflex should be considered carefully; however, further investigation is needed to identify the relationship of this reflex in children with different developmental disabilities and the expected duration between integration of the plantar grasp reflex and attainment of independent ambulation. The effect and interaction of treatment programs must also be investigated.

**Acknowledgments.** I would like to acknowledge the assistance of R. Dwain Blackston, MD; Lang Kucera, BS, RN; and Susan Tauber, BS, OTR.

## REFERENCES

1. Milani-Comparetti A, Gidoni EA: Routine developmental examination in normal and retarded children. *Dev Med Child Neurol* 9:631-638, 1967
2. Touwen B: Neurological development in infancy. In *Clinics in Developmental Medicine*, no 58. Philadelphia, PA, Spastics International Medical Publications, J B Lippincott Co, 1976, pp 63-66, 97
3. Bayley N: Bayley Scales of Infant Development. New York, NY, The Psychological Corporation, 1969, pp 79-98
4. Peiper A: Cerebral Function in Infancy and Childhood. New York, NY, Consultants Bureau, 1963, pp 158-162, 285-288
5. Gunsolus P, Welsh C, Houser C: Equilibrium reactions in the feet of children with spastic cerebral palsy and of normal children. *Dev Med Child Neurol* 17:580-591, 1975
6. Beintema DJ: A Neurological study of newborn infants. In *Clinics in Developmental Medicine*, no 28. Philadelphia, PA, Spastics International Medical Publications, J B Lippincott Co, 1968
7. Frankenburg WK, Dodds JB, Fandal AW, et al: Denver Developmental Screening Test. Denver, CO, University of Colorado Medical Center, 1975