

## Palmar Grasp Reflex in Human Newborns

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### Abstract

**Purpose:** To review palmar grasp reflex in human infants regarding psychomotor development.

**Method:** "Palmar grasp reflex" and "grasping reflex" were searched in scientific journals published between 2000 and 2016. Two groups were identified in newborns up to six months: (1) Palmar grasp reflex was studied as part of instruments of neuropsychomotor evaluation. (2) Palmar grasp reflex was taken as a dependent or independent variable.

**Results:** Eighteen articles were selected. Four were excluded because of inappropriate methods. Concerning the fourteen remaining, ten were included in group 1 (A) and four in group 2 (B).

**Conclusions:** Palmar grasp reflex may be part of different instruments used to evaluate clinical and developmental studies. It may be easily detected without a necessary environment. Its intensity may be used as an index for acquisition of motor skills and lateral differences may be associated with hand preference in adults.

**Keywords:** Grasp reflex; Psychomotor evaluation; Laterality; Human neonate; Literature review; Psychomotor development

### Introduction

Human babies exhibit spontaneous movements and primitive reflexes elicited by proper stimulations. According to Colson et al. [1], these reflexes and spontaneous movements develop during fetal life and observed in healthy infants born in terms. Capute and Accardo reported that they may be related to voluntary movements, originating from the brainstem, but later being suppressed by myelination of the supraspinal centers [2].

The palmar grasp reflex is elicited in babies up to four months after birth, by touching the radial part of the palmar surface, between ring and index fingers. The reflex response is the rapid flexion and adduction of the fingers of the stimulated hand [3].

The presence of palmar grasp reflex allows to measurement of the flexor tonus necessary for grasping movements of hands, and, possibly of legs. According to Herschokovitz et al. [4], its existence is important so the infant is capable to perform manual grasping in his first weeks of life. When the palmar grasp reflex manifests in infants older than four months, this may indicate a damage in the central nervous system, caused by anoxia, neural degenerations, traumas, among other etiological factors [5,6].

The traditional neurological examination of infants should always include the primitive reflexes, such as the palmar grasp reflex [7-10]. However, Campbell et al. [11], Prechtl [12], Campbell and Hedeker [13] and Prechtl [14] questioned the validation of the examination of

the primitive reflexes, recommending, instead, the examinations of spontaneous movements of infants, assuming it has a higher predictive value for the developmental disorders. On the other hand, Romeo et al. [15] and Romeo et al. [16] have argued that the integration between primitive reflexes and spontaneous movements [14] would be more reliable, with a higher diagnostic value. Glick [17] accepts that, during the neurological evaluation, several responses from the primitive reflexes are observed, but they are not always part of a constructive diagnosis because the examiners cannot associate the results of the primitive reflexes with any clinical interpretation.

Beyond possible clinical applications, palmar grasp reflex was defined as a variable with right-left differences, indicating a spinal motor lateralization even in babies, within a few days after birth, also exhibiting significant sex differences in newborns [18]. In another study, Tan and Tan [19] observed palmar grasp reflex as a sign of early manifestation of cerebral laterality. In both studies, the intensity of the palmar grasp reflex was measured using equipment traditionally used to measure the electrical current strength connected to a balloon. The baby should touch this balloon, eliciting a grasp reflex, which changed the current strength in the ammeter. In other studies, palmar grasp reflex was investigated with the aim to find any relation of the grasp reflex strength to the serum testosterone concentration [20,21] and variation of blood's pH values in the umbilical cord blood [22]. The familial sinistrality was also studied in relation to the grasp reflex asymmetry [23]. The research on palmar grasp reflex will not only help health professionals in neurological diagnosis, but also give important clues for new studies, using the palmar grasp reflex as a variable related to other factors intrinsic to human development. In light of these

considerations, the aim of the present work is to review the scientific literature with regard to palmar grasp reflex in human newborns and its relation to its predictive value for the infant development.

## Method

### Search strategy

To accomplish this bibliographical research, the publications on the palmar grasp reflex were scanned using the site of CAPES (Periodicals of the Coordination of Improvement of People in Superior Level). In doing so, editors who ensemble their respective periodicals were chosen, in order to facilitate the search in their contents. The selected web sites were: Science Direct On line, Blackwell, Cambridge University Press, Oxford University Press, Sage Collection, Springer, American Medical Association (AMA), Wilson, Ingenta, Taylor and Francis, Lippincott Williams and Wilkins, including the data from Ovid and Scielo, to obtain more references.

To define the research terms, the keywords proposed by Edwards et al. [3] were used in the article where the authors demonstrated how palmar grasp reflex was named over many years. The selected keywords were: palmar grasp reflex, grasping reflex, reflex squeeze grasp, primitive squeeze. These four keywords were cited as follows: palmar grasp reflex (1150 times) and grasping reflex (7030 times),

being the most frequently used keywords appeared in Google. Only articles written in English between 1998 and 2008 were selected, and they were grouped as follows:

**Group A:** The articles in which palmar grasp reflex was cited as part of instruments of neuropsychomotor evaluation, applied to new-borns up to six months. Then, they were divided into five subgroups, named according to the instrument of evaluation the authors used.

**Group B:** The articles in which palmar grasp reflex was cited as a dependent or independent variable in studies on newborns up to six months.

Six months was the age chosen as limiting each group following Zafeiriou [24], who argued that this age is the maximum limit for the palmar grasp reflex to be considered as an adequate response in the motor development of typical infants.

## Results and Discussion

Eighteen articles were found in line with our criteria. However, four of them were excluded because they did not present situations where the test of palmar grasp reflex was done. They were Zafeiriou [24], Glick [17] Striedter [25] Futagi and Suzuki [26]. Of fourteen selected articles, ten belonged to Group A and four to Group B, as presented in Table 1.

	Group A	Group B
	Articles in which palmar grasp reflex was cited as part of instruments of neuropsychomotor evaluation.	Articles in which palmar grasp reflex was cited as a dependent or independent variable of research.
	McMaster et al. [27]	Sann and Streri [28]
	Shin et al. [29]	Colson et al. [1]
	Gao et al. [30]	Tan and Tan [20]
	Young et al. [31]	Dionisio et al. [32]
	Chaudhari and Deo [9]	
	Hieu et al. [33]	
	Philippi et al. [34]	
	Pedroso and Rotta [35]	
	Jain et al. [36]	
	Ericsson et al. [37]	
Total	10 articles	4 articles

**Table 1:** Summary of study data.

### Group A articles

Analyzing Group A articles showed that it was identified that palmar grasp reflex was included in five instruments of neuropsychomotor evaluation. These instruments served as grouping criteria with following subgroups:

**Neonatal behavioral assessment scale (NBAS):** NBAS was proposed by Brazelton and Nugent [38], for evaluation of newborns up to two months. This consists of 27 behavioral items, scaled from 1 to 9, 1 is attributed to the weakest response and 9 to a maximum response.

Eighteen reflexes scaled from 0 to 3 are also evaluated in which 0 is for absent and 3 strong or exaggerated. Similarly, the examiner sums all of the scores and divides it by the number of items in each data group (Motor System, Control to Environmental responses, Social Interaction, Organization, Regulation, and Autonomous Stability). The higher the score, the better the development [38].

Shin et al. [29] used NBAS in a descriptive study with the objectives of characterizing a standard response of a group of healthy infants born in terms and describing behavioral patterns in the first days of Korean babies. Among other variables analyzed, palmar grasp reflex

was present and with intensity characteristic of healthy newborns (value 2).

Young et al. [31] investigated the influence of pre and postnatal exposition to organophosphorated pesticides in 388 infants up to two months of age. NBAS scores and urinary metabolites were also measured. Alterations in reflex strength, among them the palmar grasp reflex, were diagnostic for cerebral palsy. In this case, the need to create new neuropsychomotor tests was pointed out, so that the group could be followed with follow-up studies.

**Neonatal behavioral neurological assessment (NBNA):** NBNA was proposed by Bao et al. [39]. It has its scores adjusted to Chinese newborns and it is formed by twenty items based on NBNA and the revised version of Amiel-Tison Neurologic Assessment published by Amiel-Tison [40].

Gao et al. [30] examined palmar grasp reflex, using a barometer measuring the reflex force in mercury (Hg) in the developing newborns in Chinese cities. The authors suggested that the investigated group must have longitudinal following so that cumulative effects of mercury can be detected.

**Newborn neurological exam:** Mercuri et al. [10] published a systematization of the neural examinations which allows its usage in a spectrum that comprises routine clinical examinations. The neurological examination consists of verifying: a) tonus of neck and torso; b) global mobility; c) orientation and alertness; d) adaptability; e) tonus; f) reflexes including palmar grasp reflex; g) irritability; h) signs of abnormality - convulsion, abnormal movements of the eyes, diminution or lack of audio or visual sensibility.

McMaster et al. [27] reported a case of an eleven-week infant who presented generalized flaccidity and refusal of food. The exam showed palmar grasp reflex and other primitive reflexes preserved, however, clinical exams pointed botulism diagnosis.

Chaudhari and Deo [9] reported a research of neurodevelopmental characteristics of infants and concluded that primitive reflexes, among them palmar grasp reflex, disappeared within the end of the third month after birth.

Jain et al. [36] presented a case of a sixteen-day infant with anterior cervical arachnoid cyst, which is found very rarely in the scientific literature (only sixteen cases were detected in the bibliographical literature). One of the signs was weakness of palmar grasp reflex.

Pedroso and Rotta [35] review the neurological examinations in newborns. They examined 1066 babies and established a test routine, which converged on the routine of exams proposed by Mercuri et al. [10]. The data showed a strong positive correlation between gestational age and grasp-reflex strength, including other primitive reflexes.

Mercuri et al. [10] presented a methodology to analyze the postural asymmetry in newborns. They established typical postural patterns and reported disorders found in newborns when these were not considered typical. Subjectively, they evaluated palmar grasp reflex and noticed different intensities depending on torso asymmetry and head position.

**Dubowitz newborn examination:** Dubowitz newborn examination, proposed by Dubowitz and Dubowitz [41] performed qualitative examinations in six groups of clinical signs: tonus, reflexes, movement, abnormal and behavioral signs. However, this was criticized by other researches because of their quantitative analysis. In another study

published by Dubowitz et al. [42], scores were attributed to groups of signs allowing quantitative analysis.

Hieu et al. [33] used a summarized version of Dubowitz newborn examination to investigate developmental characteristics in 58 Vietnamese newborns. The study showed differences in ten of twenty-five items, however, palmar grasp reflex did not show any difference between the two samples.

**Movement assessment of infants (MAI):** Since its publication in 1980, Movement Assessment of Infants (MAI) has been used by clinicians, physiotherapists and other professionals, who needed a motor evaluation during therapeutic interventions. There are 65 items concerning muscular tonus, primitive reflexes, automatic responses and voluntary movements. All of these items are scored and the highest mean showed the worst diagnosis [43].

The evaluation was performed in children in their first year after birth [44]. However, there are also studies performed with children between twelve and twenty-four months [45].

Ericsson et al. [37] followed longitudinally the motor development of children from five months to five and a half years. None of five-month children evaluated by MAI presented palmar grasp reflex. The authors concluded that infants who suffered from intraventricular hemorrhage and retinopathy of prematurity obtained low development and needed individual following for being considered serious cases.

None of the selected articles related to the presence or absence of palmar grasp reflex in relation to infant development, with exception of Jain et al. [36]. This suggests that (1) the instruments described above were not used with populations that presented neuropsychomotor disorder which could alter the response of palmar grasp reflex; (2) the instruments are not sensitive enough to measure the alterations in palmar grasp reflex, because Capute et al. [46] showed that the reflex can present different intensities; (3) many signs are investigated but not all of them interpreted correctly to make any conclusion; (4) the necessity of development and after application of an equipment which quantify the intensity of palmar grasp reflex in different populations is required.

## Group B articles

This group presents the articles where palmar grasp reflex and its intensity were analyzed as a dependent or independent variable.

Sann and Streri [28] performed experiments to test the infants concerning shape and texture perceptions of objects. These objects presented two different sizes and textures. The infant used palmar grasp reflex in order to keep the object held. The time when the object was held was measured and related to size and texture. The authors concluded that the infant is capable of differentiating visual objects of different sizes and textures. However the grasping time is not significantly changed.

Colson et al. [1] analyzed primitive reflexes during feeding and noticed that they depend on the position of the infant during holding. In this study, palmar grasp reflex was present in all positions.

Tan and Tan [20] used the same equipment used by Tan and Tan [19] to relate the strength of palmar grasp reflex to the testosterone levels measured in the umbilical cord. They concluded testosterone would be an important hormone determining the cerebral lateralization, but it may not be a determining factor for hand preference.

Dionisio et al. [32] evaluated the strength and intensity of the handgrip in the first 72 hours of life in term infants and found that the force increases during the hours of birth being stronger in the left hand and in females.

In Group B articles, we noticed that (1) the infants can present behavioral alterations facing certain situations that can be detected when there are variations of intensity of palmar grasp reflex; (2) there is the need to develop technology and sensitive and reliable equipments to measure palmar grasp reflex during execution of different tasks; (3) charts with expected values of intensity of palmar grasp reflex are not suitable for comparative studies with populations exposed to neurological risks; (4) equipments are not suitable for comparative studies.

Thus, we believe that the palmar grip reflex should not only be evaluated and tested to identify cortical maturity, but also to reveal its influence on manual and lateral preference as well as voluntary movement, identifying the intrinsic and extrinsic variables of the pre-response reflex about motor skill and use it to direct the treatments.

## Conclusions

The present review suggests that the palmar grasp reflex may be a part of different instruments in evaluation of neurological examinations and developmental studies. It can be easily detected without the need of a specialized environment. However, there are no population studies, indicating any risk during motor development of infants, using the palmar grasp reflex. Measurement of the grasp-reflex strength may provide important information with regard to the development of motor skills and cerebral laterality in infants. The right-left difference in the grasp-reflex strength in newborns may be an index for the future development of hand preference due to intrinsic and extrinsic variables such as hormonal influences and intrauterine positioning. Grasp reflexes elicited in normal time spans may be an indicative and facilitative for the analysis of emergency of more complex developmental traits in human infants.

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