بسم الله الرحمن الرحيم

(و قل ربي زدني علما)

CORRELATION BETWEEN HAND POSITIONS AND CORTICAL SENSATION IN NORMAL CHILDREN

العلاقة بين وضع اليد واحساس القشرة المخية
فى الأطفال الأسوياء

By

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Finally thanks to all children who participated in the study as well as their families who accepted the participation of their children in this study.

Introduction

- The human hand is a complex structure that performs various functions for activities of daily living and occupations (**Lee and Jung, 2015).**

- For most of fine motor activities, the wrist is held straight or in a slightly extended position as this position helps to provide anatomical balance between the small muscles in the hand and fingers. It also helps the thumb to easily oppose the other fingers to manipulate small objects and the fingers can curl into a position that allows stability of the hand (**Kurtz, 2008**).

- If hand contracts in fully flexed position it is not only non functional position but also presents hygiene problem. An unusable hand caused by fixed flexion contracture of the wrist joint and the thumb-in-palm deformity of the hand is frequently seen in cerebral palsy children (**Pantó et al., 2008**).
- Cortical sensory processing is primarily a function of the parietal lobe. The parietal lobe functions to analyze and synthesize the individual varieties of sensation and to correlate the perception of the stimulus with memory of the past stimuli to interpret the stimulus and aid in discrimination and recognition (**Campbell, 2013**).

- Stereognosis involves the perceptual skill that allows the individual to identify common shapes and objects without the use of vision. It is dependent on intact parietal cortical function **(Lewis, 2003).**
- The Nottingham sensory assessment scale (NSA) presents a standardized way of assessing stereognosis of familiar objects in a manner that is easily available, repeatable and does not require high cost equipment for its administration **(Lima et al., 2010).**

Statement of the problem

- Is there a Correlation between hand positions and cortical sensation in normal children?

Purpose of the study

- The aim of the study is to establish data about two hand positions and cortical sensation in form of stereognosis in normal children.

Significance of the study

- Sensory feedback is known to be important for refining and improving motor performance. Stereognosis is overall accepted amongst researchers as a good measure of discriminative sensory function **(Fedrizzi et al., 2003).**
- The common cases in pediatric physical therapy field are cerebral palsy. Thirty one of children with cerebral palsy have hemiplegia, or unilateral upper and lower extremity involvement **(Shevell et al., 2009).**

- Motor and sensory impairment are prominent characteristics of hemiplegic cerebral palsy. One of the most prevalent sensory problems in cerebral palsy is astereognosis which has special importance in daily manual functions **(Hasani and Taghizade, 2013).**

- Given the high percentages of experiencing both motor and sensory dysfunction in cerebral palsy children , significant attention to sensation and movement, as well as the interaction between them, is critical for improving function in children with hemiplegia **(Krumlinde-Sundholm and Eliasson, 2002)**.

Subjects, Materials and Procedures

Subjects

- Two hundred normal subjects of both sexes were participated in this study.

Inclusion criteria

- Subjects with the following criteria were enrolled in this study:
- Their age range 6-8 years old.
- They are able to follow the instructions.
- They are able to express themselves by speech

Exclusive criteria

- They have central nervous system (CNS) injury or dysfunction.
- They have hand injury, fracture or recent wound.
- They made orthopedic hand surgery.
- They have visual defects.
- Children attacked by common cold at last two weeks.

Pilot study for hemiplegic cerebral palsy

- Before the beginning of this study, pilot study was conducted in twelve hemiplegic cerebral palsy children aged from 6 to 8 years old.
- Collected data from these children concluded that:

❖Common cases had moderate spasticity.

❖Average wrist flexion 50-60 degree.

❖Average metacarpophalangial joint flexion 30-40 degree.

❖Average interphalangial joint flexion 35-40 degree.

procedures

Child preparation:

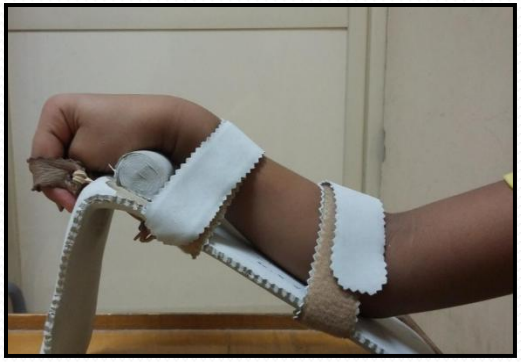
- The participants sat on comfortable chair according to their age. Forearm and hand lengths were calculated to ensure that the device suitable for them.
- Any accessories were removed from the hand.
- Stereognostic tools were presented in front of the child .The ten objects demonstrated to the child to ensure that he know them.

Stereognosis testing was done for dominant and non dominant hands from two positions

A- Stereognosis testing in functional hand position:

- Each object was placed in the child's hand while he/she blind folded. The hand was free to move through wrist and finger extension without any restriction.
- Stereognosis was tested using Nottingham sensory assessment scale. The child tried to identify ten different familiar objects.
- Each object was placed in the child's hand while he/she blind folded for a maximum of 15 seconds.
- Identification is by naming, description or by pair-matching with an identical set (**Carlson and Brooks, 2009**).

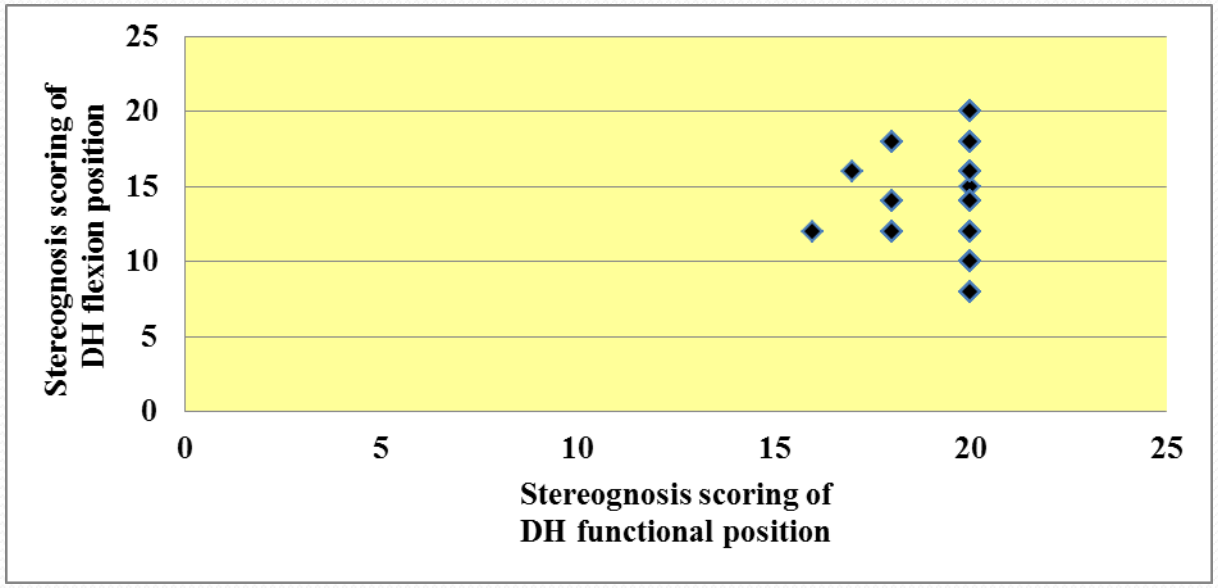
B- Stereognosis testing in flexion hand position:



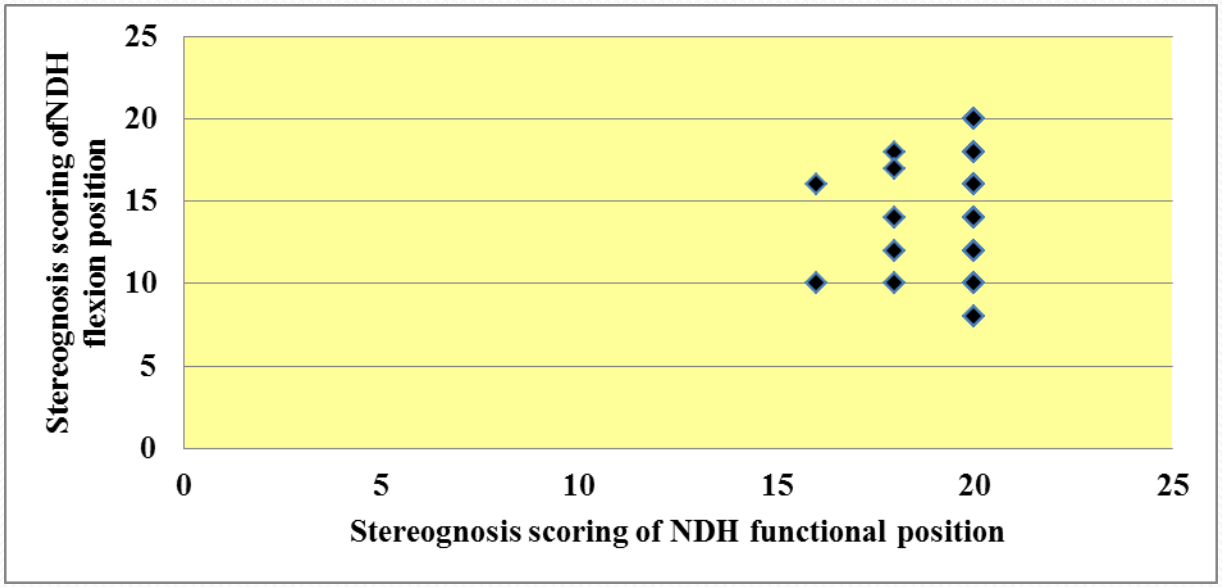
- Normal hand was placed in simulated hemiplegic position by means of a platform device in forearm pronation, wrist flexion, digit flexion, and thumb adduction.
- Each object was placed in the hand while it was placed in the platform simulating hemiplegic position. Then the test was done.

Results

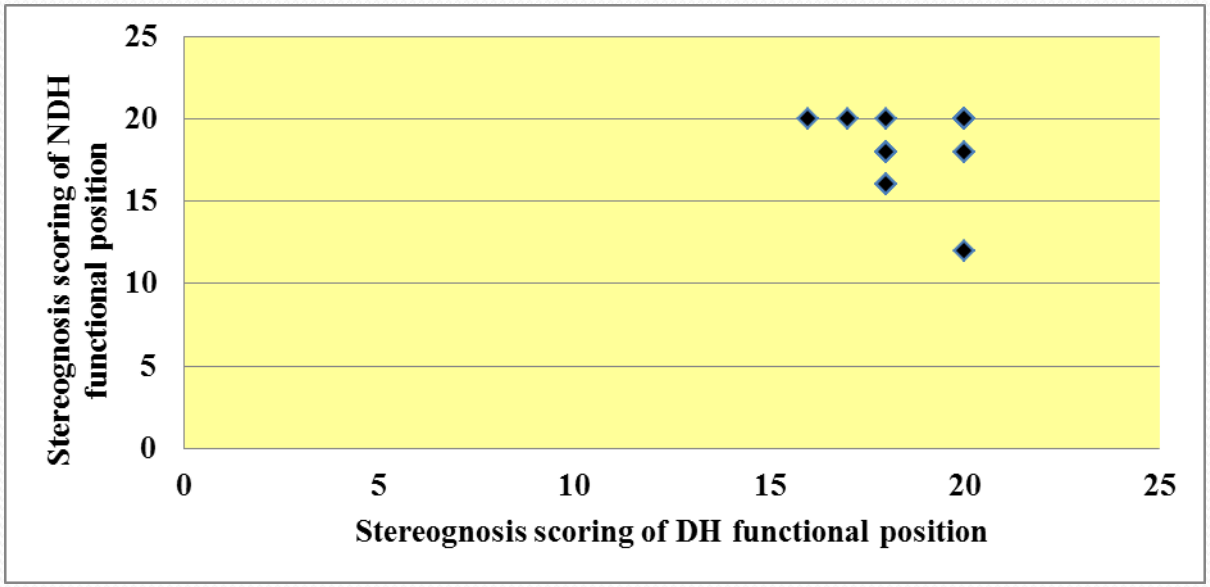
Correlation between stereognosis scoring of DH functional position and DH flexion position.



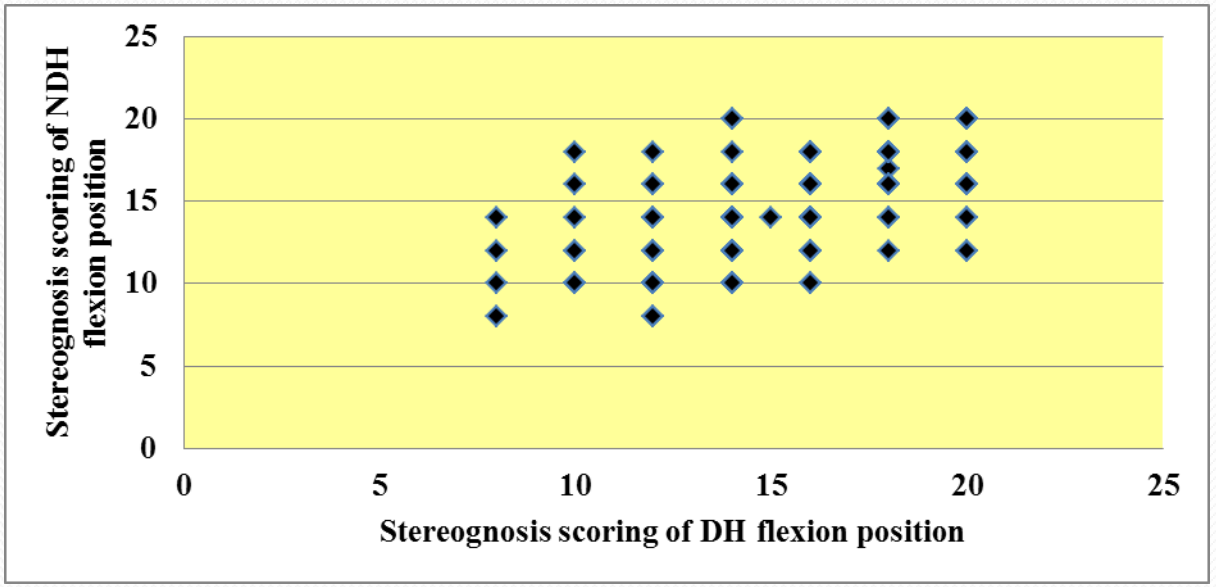
Correlation between stereognosis scoring of NDH functional position and NDH flexion position



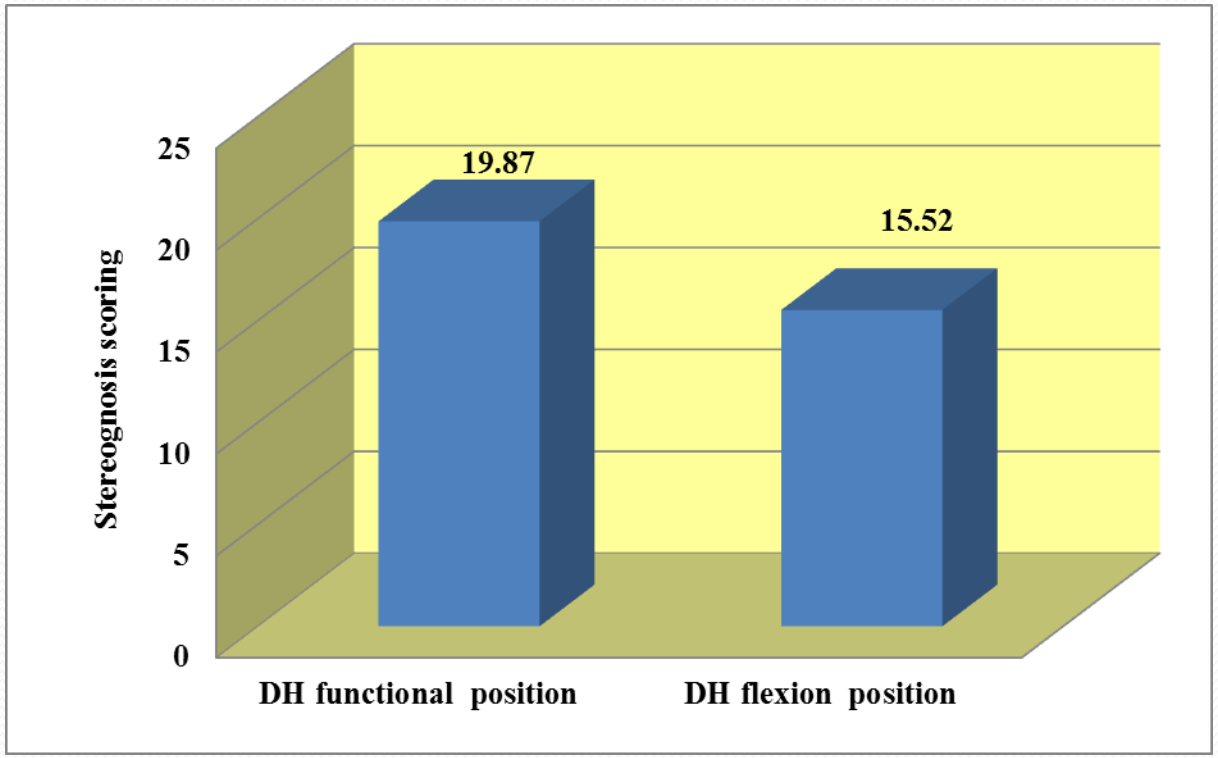
Correlation between stereognosis scoring of DH functional position and NDH functional position



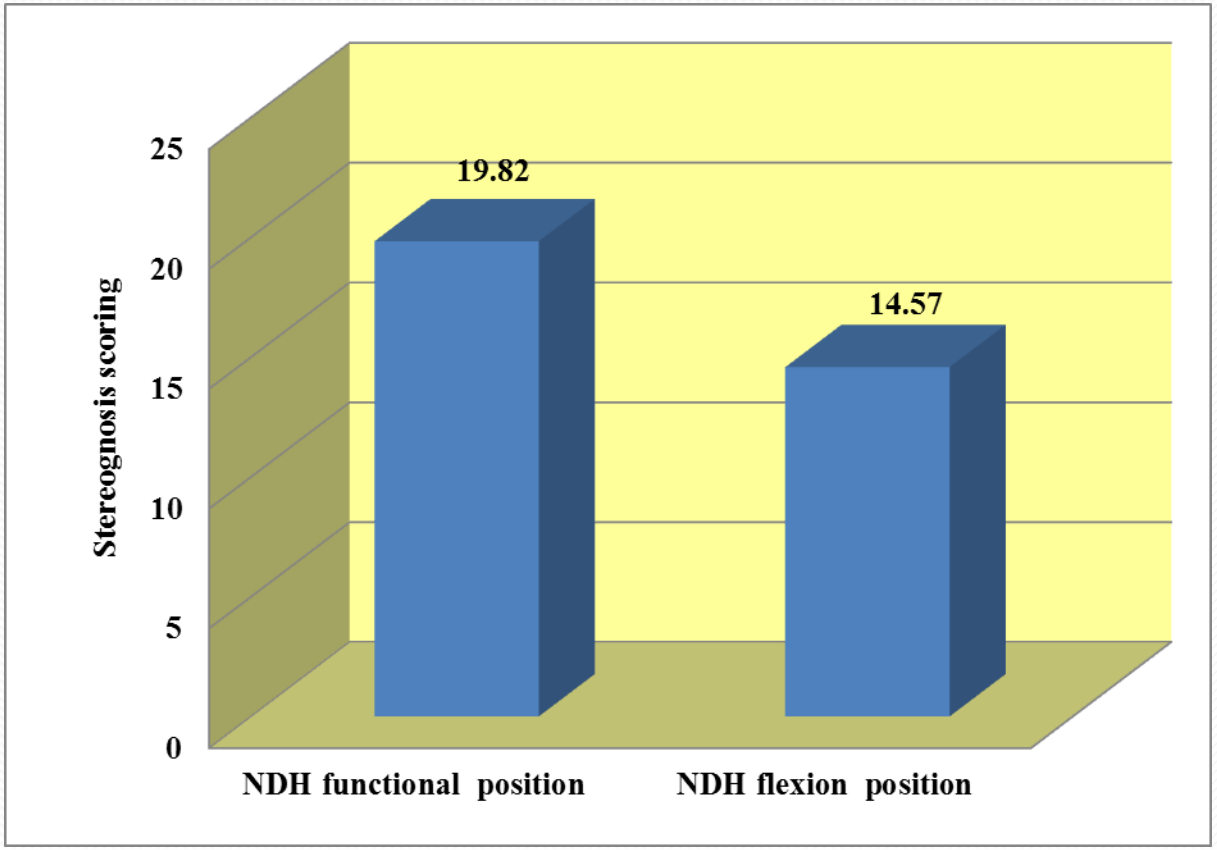
Correlation between stereognosis scoring of DH flexion position and NDH flexion position



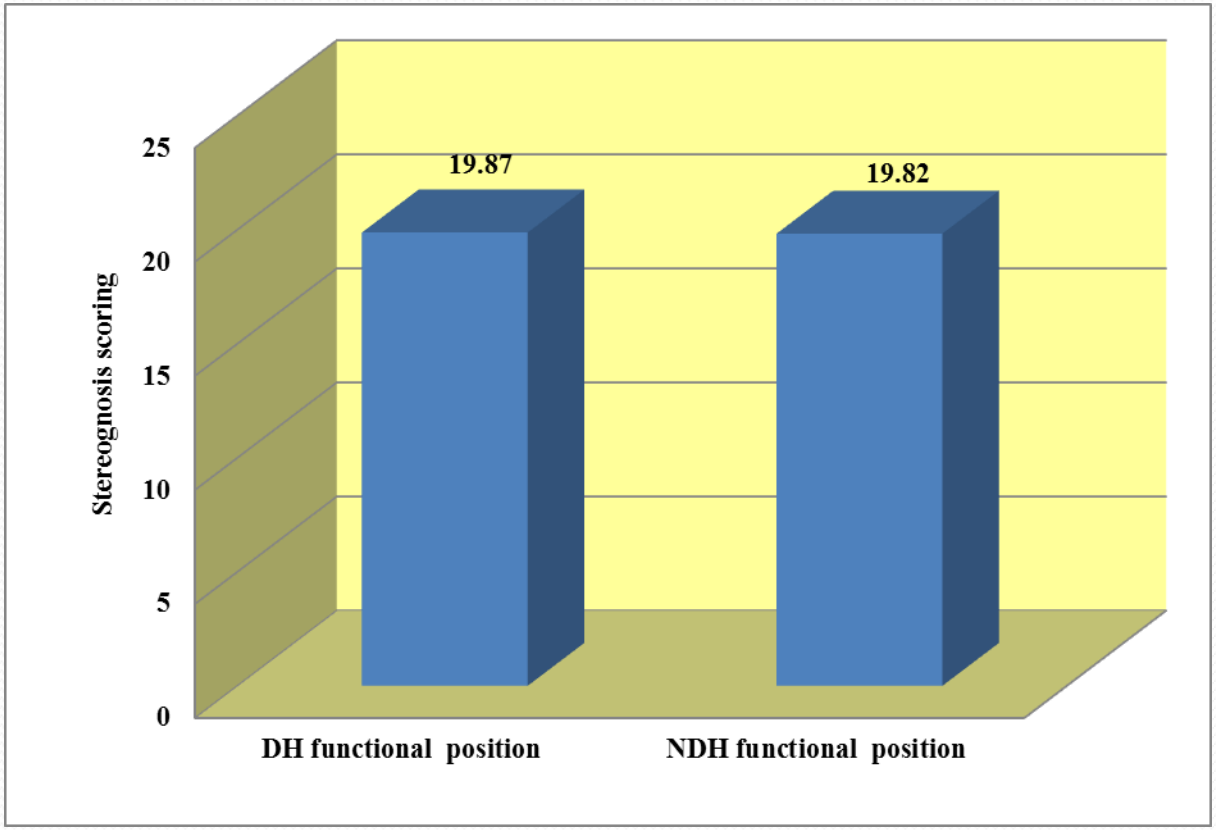
Comparison between stereognosis scoring of DH functional position and DH flexion position



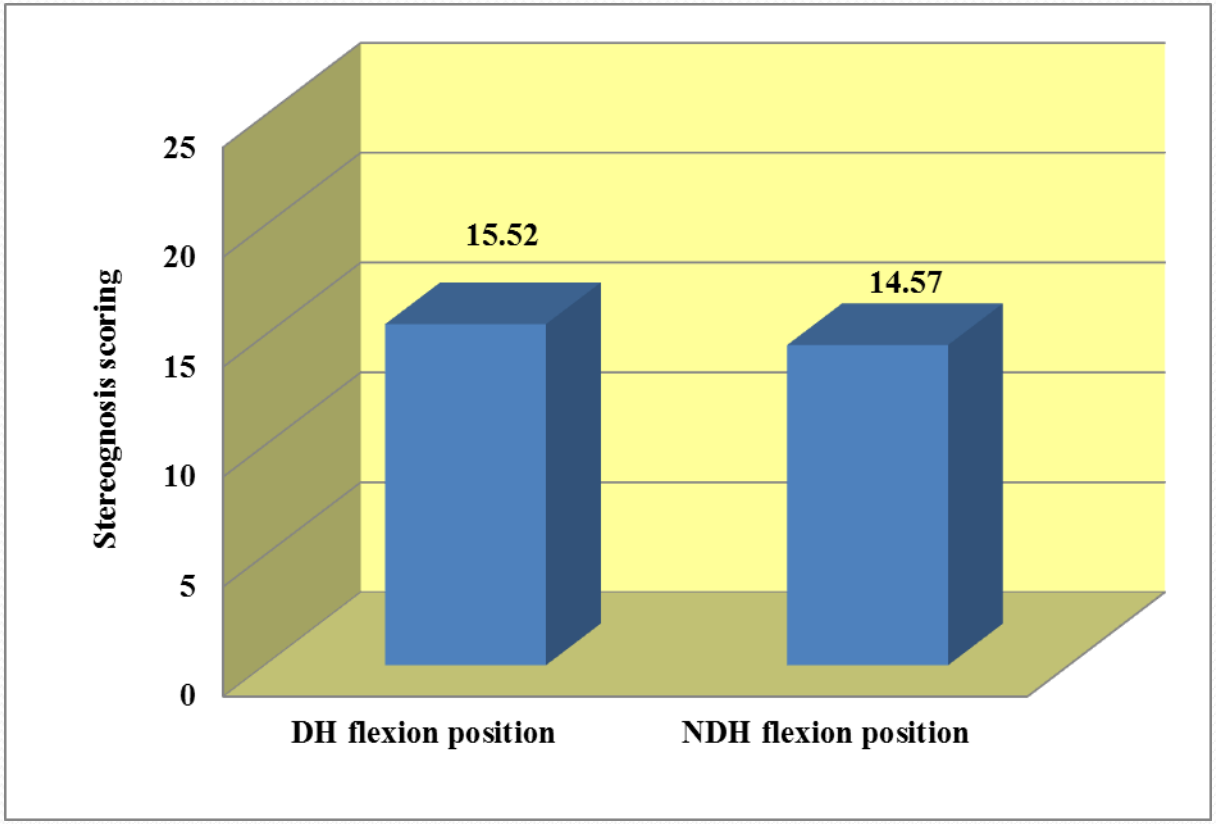
Comparison between stereognosis scoring of NDH functional position and NDH flexion position



comparison between stereognosis scoring of DH functional position and NDH functional position



Comparison between stereognosis scoring of DH flexion position and NDH flexion position



Discussion

- These results matched with the results conducted by **Carlson and Brooks (2009)** which revealed that normal subjects had significantly decreased stereognosis scoring when placed in a simulated hemiplegic hand position with decreased digital and wrist extension than in the normal hand position .

- **Bhardwaj and Sabapathy(2011)** reported that the flexion contracture of the wrist causes difficulty in stabilizing the wrist in extension to allow the hand to grasp effectively and also alters the normal pattern of grasp of the hand. The thumb which held flexed inside the palm impairs hand grip and obstructs the function of other fingers and also the lack of abduction and extension limits the size of the object that the child can grasp.

- **Auld et al. (2012)** demonstrated that there were no differences on any tactile tests including single-point localization, double simultaneous, stereognosis and texture perception between the dominant and non dominant hands of typically developing children.

conclusion

- In conclusion altered hand position and decreased it's mobility affect stereognosis even if there is no problem in the cortical parietal lobe area.

- In practical while dealing with hemiplegic cerebral palsy children careful examination of the musculoskeletal system must be done and any abnormality that may affect sensory function must be corrected before starting any sensory reeducation program.

RECOMMENDATIONS

In the light of research results, the following recommendations may be considered:

- Application of the obtained results in clinical practice during designing treatment program for hemiplegic cerebral palsy children.

- Examine the effect of different wrist extension angles on sterognosis in normal children to determine the optimal functional hand position.

- Examine the effect of different hand positions on stereognosis among different age groups.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