VISUAL PERCEPTUAL ABILITIES IN OBSTETRIC BRACHIAL PLEXUS PALSY - AN INVESTIGATION OF THE INCIDENCE AND A COMPARATIVE ANALYSIS

DISSERTATION BY

ORNISSA NUKANNA

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE:
MASTER OF OCCUPATIONAL THERAPY

SUPERVISOR : PROFESSOR K.S.NAIDOO
CO-SUPERVISORS : MRS SANTIE VAN VUURAN
MS. ROBIN W. E. JOUBERT

DEPARTMENT OF OCCUPATIONAL THERAPY
FACULTY OF HEALTH SCIENCE
UNIVERSITY OF DURBAN WESTVILLE

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DECLARATION

Academic Registrar
University of Durban Westville

15 January 1998

Dear Sir

I, Ornissa Nukanna,

Registration Number 8625232,

Hereby declare that the dissertation entitled:

Visual perceptual abilities in Obstetric Brachial Plexus Palsy -

An investigation of the incidence and a comparative analysis,

is the result of my own investigation and research and that it has not been submitted in part or in full for any other degree or to any other University.

..... 15/1/98

O.NUKANNA (Signature) Date

THIS IS NO FORMAL DEDICATION

FOR,

ALL IS HIS

AND

RETURNS TO HIM.

-HIS

ACKNOWLEDGEMENTS

It is my first and foremost duty to express my debt of gratitude and thanks to all those who assisted me in my Research and Dissertation.

I express my *gratitude* first to my Divine Master, without whose inspiration this project would have never come to fruition. He guided and encouraged me throughout, and whenever I met an area of darkness, he brought light.

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LIST OF ABBREVIATIONS

DTVP	Developmental Test of Visual Perception
MRVP	Motor Reduced Visual Perception
DTLA - 3	Detroit Test of Learning Aptitude (Third revision)
DS	Design Sequence (Subtest of the Detroit Test of Learning Aptitude - 3)
DR	Design Reproduction (Subtest of the Detroit test of Learning Aptitude - 3)
PF	Picture Fragments (Subtest of the Detroit Test of Learning Aptitude - 3)
Jordan's L - R	Jordan's Left-Right Reversal Test
MFPT	Motor Free Perception Test
OBPP	Obstetric Brachial Plexus Palsy
TVPS	Test of Visual Perceptual Skills
VP	Visual Perception
VMI	Visual Motor Integration
VMI (Test)	Developmental Test of Visual Motor Integration
&	And

%	Percentage
ROM	Range of Movement

ABSTRACT

Obstetric brachial plexus palsy, a traumatic birth palsy, results in the paralysis of the upper limb/s. The birth injury is treated at the Brachial Plexus Clinic at King Edward VIII th Hospital, where the Candidate forms part of the Rehabilitation Team. In keeping with worldwide trends, the focus of treatment was on rehabilitation of the upper limb/s. During the course of treatment of these patients, it was observed that the performance of these children varied from excellent to poor. This observation, has not been recorded previously, hence a Research study was initiated to invesitigate this aspect of performance.

The study comprised thirty children, between the ages of four and seventeen, whose paralysis was assessed in the conventional pattern. In addition, the visual perceptual abilities of these children were assessed in a variety of batteries, catering for the wide age range.

These were:
Developmental Test of Visual Motor Integration (1989),
Motor Free Perception Test (1972),
Developmental Test of Visual Perception (2nd edition),
Test of Visual Perceptual Skills - Upper and Lower levels (Gardner),
Jordan's Left-Right Reversal Test (1974),
Clinical (Ayres) and General Observations.

Although traditionally viewed as a physical disorder, the results of the study indicate that children with obstetric brachial plexus injury present with a significant incidence of below average performance, against the normal population, on most of the assessment batteries. No significant relationship could be established between the severity of the lesion and visual perceptual abilities, owing to the disproportionate numbers of children amongst the different lesions. Further research is required to support and consolidate the findings of this study. It is also recommended that Occupational therapists screen for visual perceptual deficits in such injuries, thus facilitating

holistic patient management.

CHAPTER I

INTRODUCTION

The Candidate has been part of the rehabilitation team of the Brachial Plexus Clinic at King Edward VIII th Hospital for the past four years.

Continued observations of obstetric brachial plexus palsy (OBPP) children, during this time, were made. A certain number of OBPP presented with a poor school performance, whilst some excelled at school. Specific patterns of deficiency such as handedness, attention and concentration were being identified in a variety of clusters and degrees of severity. Poor school progress had been noted by Professor K.S.Naidoo (Supervisor of the study), having been in charge of the Clinic for the past nineteen years. The correlation between OBPP and poor/ excellent school progress has however, not been assessed through formal research.

1.1. OBJECTIVES OF THE STUDY

OBPP was first diagnosed in 1764 (Covey et al, 1992). There has however been no research which addresses the visual perceptual abilities of OBPP children.
Hence the study's objectives are:

a) To ascertain the incidence and areas of visual/motor perceptual abilities and disabilities in children with OBPP injuries.
b) To provide relevant scientific information on the visual/motor perceptual abilities/disibilities of OBPP injuries, in order to determine if early assessment and treatment of such abilities/disibilities are necessary.
c) To promote an awareness and initiate interest among Occupational Therapists in visual/motor perceptual abilities in OBPP children. Hence this would ensure more holistic patient management.
d) To promote further research in the visual/motor perceptual abilities of the OBPP patients, like the cause of such abilities/disabilities.

1.2. HYPOTHESIS

Occupational dysfunction refers to dysfunctional behaviours which disrupt the child's ability to gain mastery over his or her skills. OBPP, often resulting in the paralysis of the upper limb has been traditionally viewed as a physical disability. Perceptual skills are viewed as a component of occupational function. Hence it is hypothesized that,

a) Children with OBPP have physical impairment, as well as impairment in visual/ perceptual skills.

b) A significant number of OBPP children present with below average visual perceptual skills, and not above average visual perceptual skills.

c) A positive correlation exists between the severity of the lesion of the OBPP injury and of visual/motor perceptual abilities.

CHAPTER 2

LITERATURE REVIEW

2.1. OBSTETRIC BRACHIAL PLEXUS PALSY

2.1.1. HISTORICAL REVIEW AND OCCURANCE

Birth injury of the brachial plexus was first described by Smellie in 1764 (Covey et al.1992). Narakas noted that these injuries, however were not reported in the medical literature until the eighteenth century (Bora, 1986).

OCCURRENCE

According to Narakas, in Bora(1986), the occurrence of OBPP varies from 0,3 per one thousand births in developed countries to 8 per one thousand births in underdeveloped regions. There are, however, no available statistics for South Africa.

Stephen et al. (1991), pointed out that shoulder dystocia, namely OBPP resulting from shoulder entrapment, occurs in 0,15% to 1,7% of all deliveries. Using these predictions, one may infer that, between 26 to 291 children are affected annually at King Edward VIII th Hospital. No accurate statistics for OBPP have been recorded at King Edward VIII th Hospital, KwaZuluNatal.

Although Stephen et al. (1991) maintain that these predictions are controversial, the Candidate supports Janhka (1991) who proposes that OBPP remains a significant problem despite improvements in obstetric and perinatal care.

2.1.2 ANATOMICAL BACKGROUND

A] THE BRACHIAL PLEXUS

The brachial plexus is constituted of the anterior primary rami of the (Cervical)C5, 6, 7, 8 and (Thoracic)T1 spinal nerves (Romanes, 1996 and Dommisse, 1988). The nerves form a network through union and division, finally resulting in nerves that supply the motor and sensory

components of the upper limb (Refer to Figure Ia and Ib on page 5). [Also note that the Radial Nerve has components of the (Cervical)C5, which is not clearly marked on Figures' Ia. and Ib.]

B] EMBRYOLOGY OF THE UPPER LIMB

The upper limb buds appear at four weeks. At about six weeks, the limb bud becomes innervated with the brachial plexus (Narakas in Bora, 1986).

- OBSTETRIC BRACHIAL PLEXUS PALSY

OBPP is injury to the brachial plexus at birth, resulting in paralysis of the upper limb/s. This paralysis may be partial or complete.

2.1.3 AETIOLOGY

Narakas, in Lamb (1987, page 176), maintains that many overweight babies in cephalic presentations and underweight in breech presentation may develop OBPP.This is usually caused by the forceful widening of the angle between the neck and the shoulder during delivery, particularly when foetal distress causes a loss of natural muscular tone. Although there has been much debate about the aetiology, this traumatic origin of brachial plexus lesions at birth is generally accepted (Gilbert, 1990). Other causes reported by Sunderland (1991, pages 195-196) include pressure on the nerve during uterine development; from the constriction of the limb by the umbilical cord or amniotic band; abnormal tension on the nerve caused when the limb is maintained in an abnormal position in utero; involvement in regions of subcutaneous fat necrosis and intra muscular injections. Such cases are rare, as reported by Narakas (Lamb, 1987), and Gilbert (1990).

Excessive traction on the arm in the presentation of decreased muscle tone, during delivery, also can cause OBPP.

2.1.4 PATHOLOGY

According to Sunderland's (1991) nerve classification of nerve injuries, the pathology of OBPP

FIGURE Ia

Anatomy of the Brachial Plexus (Malick and Meyer, 1978)

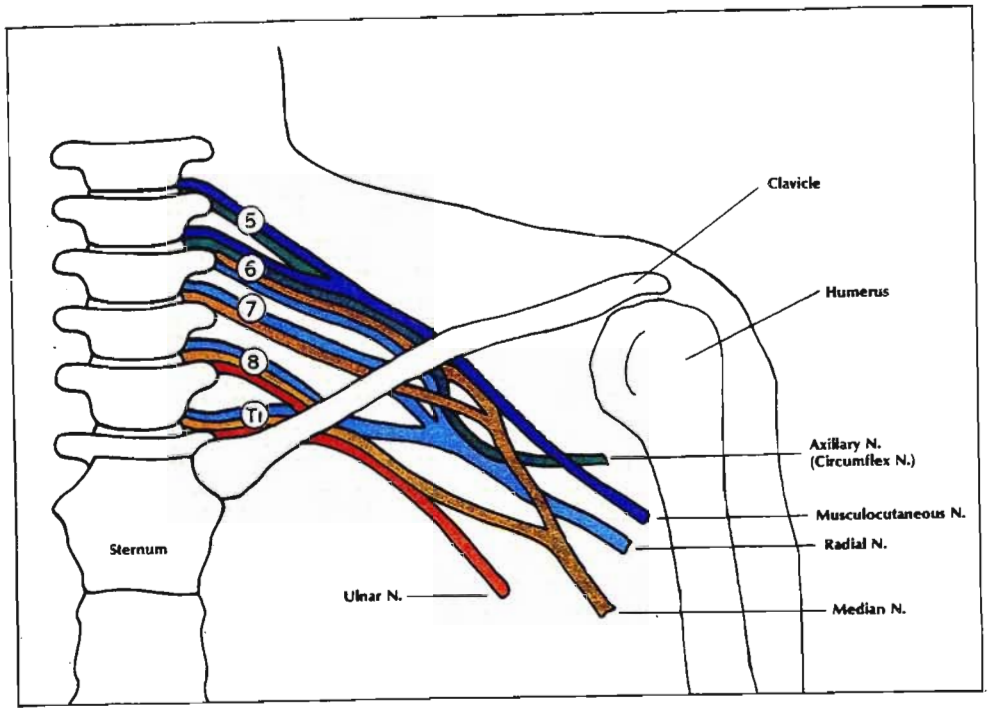

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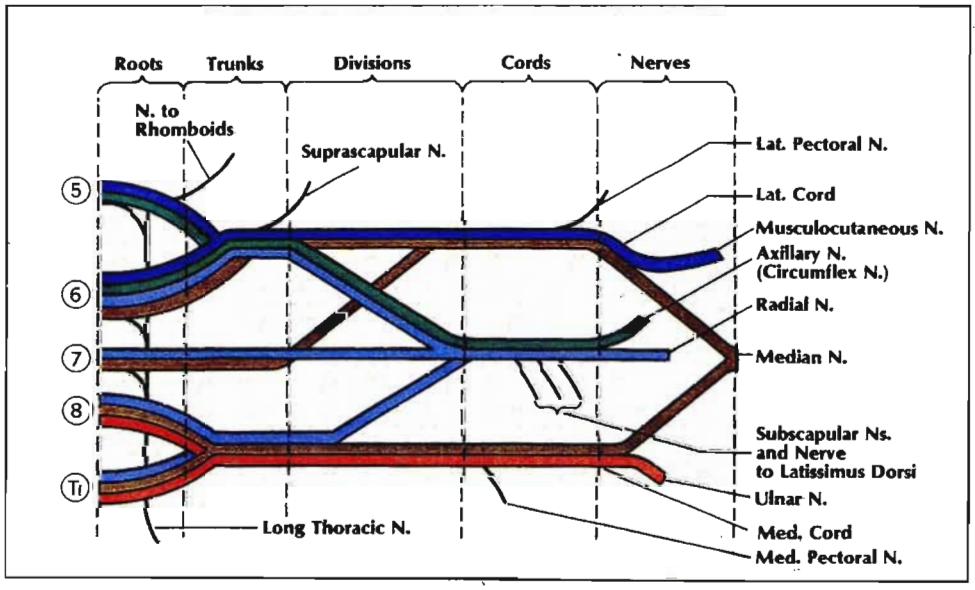
FIGURE Ib

The Brachial Plexus - Magnified (Malick and Meyer, 1978)



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can range from a degree one [1]Neuropraxia, to a degree five [2]Neurotmesis. The degree of severity of the nerve lesion will indicate the rapidity and extent to which the brachial plexus lesion will recover (Weiner, 1993).

The types of OBPP are generally divided into:

a) Upper trunk - C5, 6 (Erbs Type)

This involves paralysis of the deltoid, lateral rotators of the humerus and elbow flexors. The arm is held internally rotated forearm pronated and elbow extended or slightly flexed. The hand is normal (Seddon, 1975).

b) Upper and Middle - C5, 6, 7

It is very rare to have an isolated C7 lesion (Weiner, 1993; Sharrard and Dommisse, 1979 and Hunter et al.1990).

C5, 6, 7 lesion includes the motor loss of C5, 6 and in addition usually involves paralysis of teres major, latissimus dorsi, part of the pectoralis major, triceps and all forearm extensors (Seddon, 1975).

c) Lower Trunk - C8, T1 (Klumpkes Type)

There is paralysis of the intrinsic muscles of the hand. The hand is supinated, wrist extended and fingers clawed.

d) Mixed Lesion - C5, 6, 7, 8, T1

All three trunks are affected.

e) Total Lesion - C5, 6, 7, 8, T1

All the muscles distal to the shoulder girdle are inactive (Seddon, 1975). There is total paralysis of the upper limb.

Studies by Michelow (1994), Jahnake (1991) and Al Qattan et al. (1995), indicates that the most common injuries are the upper trunk, mixed or total lesions. In mild cases, full function of the upper limb will recover. In other cases, the OBPP child is left with residual paralysis in keeping with any of the above-mentioned types.

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[1]Neuropraxia - * *Refer to Glossary*

[2]Neurotmesis

The presence of [3]Horner's Syndrome, indicating a root avulsion carries a poor prognosis for recovery (Narakas, in Lamb, 1986, page 117). Winging of the scapular, excessive pain, and associated fractures may also indicate a root lesion. OBPP may be unilateral, occurring in any limb or bilateral ~~well~~ as well.

2.1.5 MANAGEMENT

Once diagnosed, conservative management would involve awaiting spontaneous recovery up to three months. Surgical procedures involving exploration, neurolysis and repair of damaged nerves of the brachial plexus (in infancy) have obtained some positive results. Tendon transfers, derotation osteotomy, shoulder fusion and others are amongst the reconstructive surgical approaches performed at King Edward VIII th Hospital, for the OBPP child if no recovery occurs. The reconstructive surgery is done in order to improve the child's ability to position the hand better in space, and to facilitate better upper limb function.

All the OBPP children are referred to the Occupational Therapist and Physiotherapist. The Physiotherapist would provide passive and active exercises for the upper limb, also using modalities to assist with pain management.

The Occupational Therapist, would encourage strengthening of the upper limb through the use of functional activities, dynamic splints and other therapeutic media. Contractures and possible deformities would be serially corrected or prevented where possible through the use of soft or static splints. Bilateral activities would be encouraged. Detailed preoperative and postoperative assessments and treatments are also provided. Support, counselling and education on OBPP are offered to the patient.

2.1.6 FUNCTIONAL IMPLICATIONS

There is limited literature available on the functional implications of OBPP.

Physiologically, the central and peripheral nervous system is still in maturation at birth. Injury to

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[3]Horner's Syndrome/Sign

the brachial plexus of the newborn has two major consequences.
Firstly, the vigorous growing process of the limb, depending at least partially on axonal transport of somatotrophic transport factors, is impeded. Somatosensory feedback, modelling by motor activity and maturing of the limb - consciousness is stopped.
Secondly, repair of the lesions sustained is still monitored by the mechanisms proper to the fetus. Thus the newborn's reaction will be dissimilar to that of the adult brachial plexus injury (Narakas in Lamb, 1986).

As reported by Ramlaul (1996), the OBPP child with an upper trunk lesion, usually holds the arm in approximately 40 degrees internal rotation, which is ineffective for function. Due to the muscular imbalance, scapular - thoracic movements are used for attempting shoulder abduction and this leads to the positive trumpet sign, tightening of pectoralis major, inability to isolate shoulder movement from shoulder girdle movements, postural hyper lordosis and scapular tilting.

Thus the child would use an abnormal, clumsy and ineffective movement patterns for example, in taking the hand to the face for washing. Bilateral hand function is also impaired.

The OBPP child has a tendency to be unilateral in most functional tasks - like dressing and bathing. The child has the tendency to use the affected limb in a supportive capacity, by assisting the unaffected limb in carrying large objects.

Frostick (1995), reported that the functional return of brachial plexus injuries would be less than perfect, and in many instances very limited, if not impossible.

It is hoped that with the refinement in obstetric and perinatal care, OBPP will become increasingly rare.

This section shall be explained in greater depth in 2.1(Visual perception and OBPP).

2.2. VISUAL PERCEPTION

2.2.1. PERCEPTION

Perception is viewed differently among various writers. To some theorists, the entire receptive process is called perception, meaning to' know' or to 'understand'. Others have marked a clear distinction (Hamill et al.1993, page 1).

Although Roediger et al. (1984), makes a clear distinction between sensation and perception, it is pointed out that they must be seen as two points on a continuum. Sensation is defined as the reception of stimulation from the environment through the senses. Perception is the interpretation of the sensory information relayed to the brain from the receptor organs such as the eyes, ears, nose, mouth and skin.

2.2.2. THEORIES OF PERCEPTUAL DEVELOPMENT

There appear to be two main contentions on perceptual development. Firstly, many researchers and theorists support the premise that perception and motor development are considerably interrelated (Livingstone, 1978 and Kephart, 1971).

Frostig et al maintained, supporting the first contention that perception developed out of sensory motor behaviour of the infant and in small children, depending to a great degree on exploratory movements. Three great theorists - Barsch, Getmen and Kephart, essentially support this premise (Leonard, 1986).

Leonard (1986, page 37) having reviewed these major theories noted common principles among them. These were, firstly, that human learning begins with motor learning. An understanding of the dynamics of learning necessarily involves an understanding of movement and motor development. Secondly, there is a natural sequence of a developmental stage, each stage must be acquired by the child before the next stage is added. Finally academic and [4]cognitive learning

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[4]Cognition

is based on successful motor learning experiences. A child's school problems may be due to insufficient motor experiences and gaps in motor learning. The overall principles are further supported by Todd, V.R (Kramer and Hinojosa, 1993) in the presentation of a visual perceptual theory.

Subsequently these theories have been disputed by other theorists. Cratty, as pointed out by Leornard, (1986) reviewed this literature. He found that visual perception is composed of several independent aptitude clusters. From the first hours of birth infants engage in visual behaviour, involving perceptual discrimination. This precedes their ability to move with accuracy and to contact directly the objects in the environment. Laszlo and Bairstow, in Leornard (1986), have argued that early visual skills facilitate the perception of events in the environment and this perceptual development enables the development of controlled movement. Emphasis on the first postulate, indicated that visual perception was learned through interaction with the human and non human environment. The importance of intersensory integration is stressed. However Cratty's findings led him to believe that early [5]visual motor integrations that occur when children contact their environment to move through space via locomotor behaviour, probably aids them to organize certain components of near and distant space. However, he stated that this manual - locomotor activity does not seem imperative to the formation of all visual perceptual judgements. In conclusion, he reported that there are times when the perceptual processes operate relatively independent of behaviour in the development of the infant and child.

There has been much research by Harber (1979) and Newcomer and Hammill (1973) which support the premise that visual motor perception are considerably autonomous systems.

Most clinicians and educators accept the theory of perception being an intermediate step in the information processing between intersensory integration and cognition, Newcomer and Hammill (1973), Kramer (1993). Other theorists do not emphasize the stages of perceptual motor development, but instead view the theory as 'a conceptual framework' of interrelated motor perceptual and more broadly cognitive factors (Fisher et al. 1991, page 361).

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[5]Visual Motor Integration

2.2.3. SENSORY PERCEPTUAL PROCESSING

This section describes how the different senses come together, for the development of function and skills. Emphasis will be placed on the work done by Ayres whilst taking into cognisance theories proposed by Kramer and Hinojosa (1993) and Hammill et al. (1993).

The integration of the senses begins in the mother's womb, as the foetal brain senses the movements of the mother's body as well as its own body (Ayres, 1981, page 6).

With reference to Figure II (page 12), by Ayres (1981), to the far left of the diagram are the major sensory systems. Adequate stimulations of these senses require a good flow of impulses from the receptors to the brain. Although the diagram indicates the four levels of the sensory integrative process, it does not show the fluidity of the process in life. It must be noted that everything develops together, but some functions lead to others. The meaning of the brackets indicate many components coming together. The visual and auditory systems do not make a significant contribution to the integration of the inputs of the senses. The Candidate, however tends to favour Hammill et al. (1993), Aslin and Smith (1988) and Kramer and Hinojosa's (1993) approach, viewing perception as a process in between intersensory integration and cognition. Hence the bracket that brings 'vestibular, proprioception' and 'tactile' together in the child, should indeed also include the visual and auditory senses.

The Auditory System

Auditory processing skills directly influence academic achievement, particularly language (Leornard, 1986, page 18). The auditory system assists with hearing and the understanding of the spoken word. The system is closely linked with the vestibular system as both respond to vibration (Ayres, 1981, page 41).

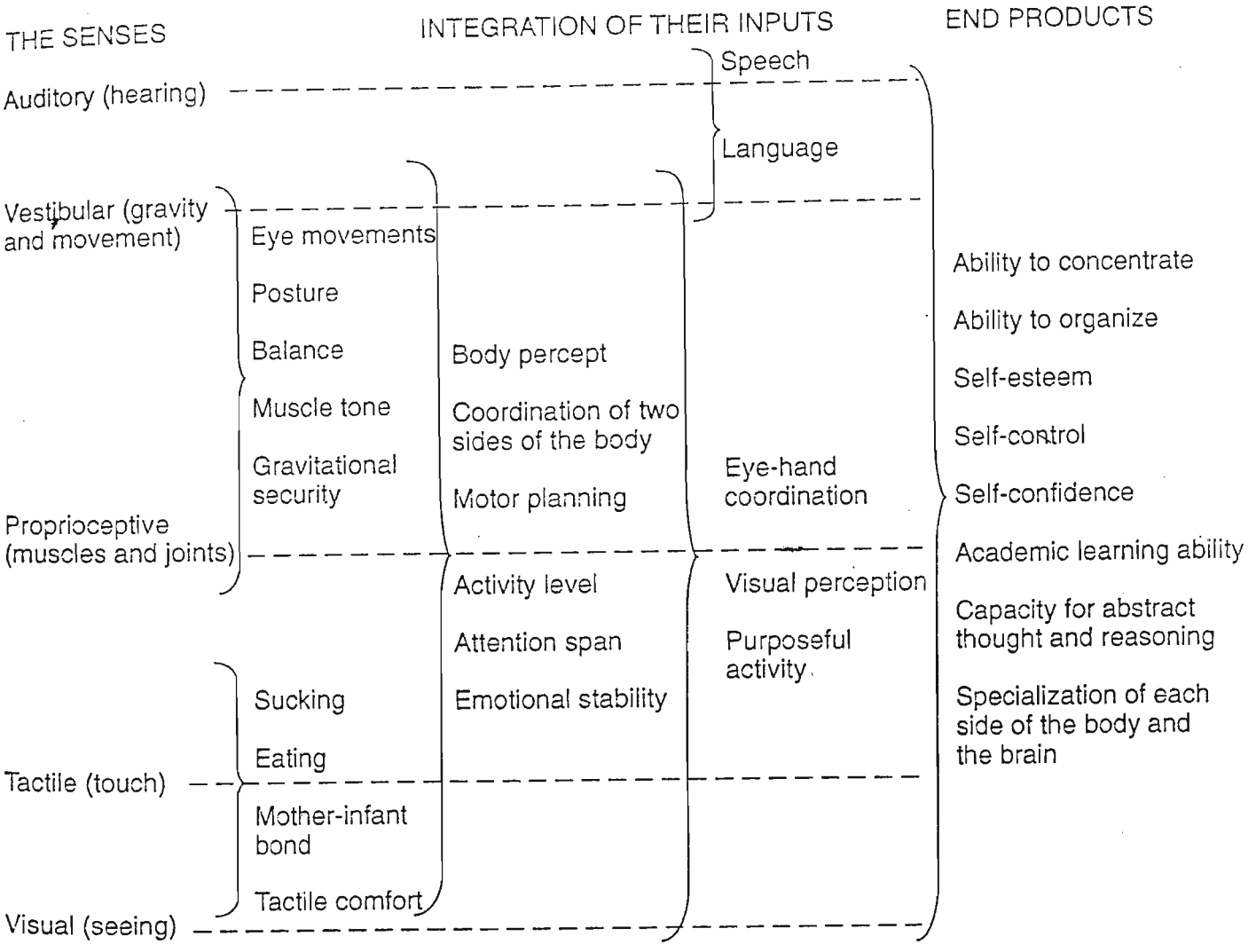
Vestibular System

Schilder(1933) and Ayres (1980) conceived the vestibular system as a coordinating apparatus for all sensory functions.

The vestibular system enables the individual to detect motion, especially acceleration and deceleration and the earth's gravitational pull. The effects of motion primarily being attributed to

FIGURE II

The senses, integration of their input and their end products (Ayres, 1979)



the semi circular canals, and gravity to the saccule and utricle. The vestibular system allows one to maintain a stable visual field. This is essential for reading, writing and other tasks. The vestibular system generates adequate muscular tone, which together with the cerebellum, allows us to move smoothly and accurately with proper timing. The system allows for postural background movements, being automatic adjustment of the body to various tasks such as when we reach for something, our trunk and legs automatically adjusts themselves so that our arm movements do their jobs efficiently. *Cocontraction* is important for the development of movement patterns for praxis. It brings about simultaneous contraction of agonist and antagonistic muscles, and stabilization of the joints for action and use (Ayres, 1981).

Vestibular and proprioceptive impulses interact to warn the brain of possible injury to the body when it is about to fall. Children with poor *protective extension* (as with the OBBP children), make no attempt to catch themselves when they fall, hence frequently hurting themselves (Ayres, 1981).

Balance generally reflects the efficacy and integration of the muscular system, (particularly the reflexes that enable children to unconsciously adjust their postures to the upright), of ocular control and of the vestibular apparatus (Cratty, 1970, page 48).

Proprioceptive System

Proprioception refers to the sensory information caused by cocontraction and stretching of the muscles and by bending, straightening, pulling and compression of the joints between the bones. Proprioception helps us to move. A dysfunction in the system would result in the body movements being slower, more clumsy and executed with more effort (Ayres, 1981).

Tactile System

The tactile system is the largest sensory system and the first system to develop in the foetus (Ayres, 1981). The system is a primary aid in the comprehension of the environment and through recognising objects through touching. It consists of two subsystems, firstly the protective system

which protects the child from danger, whilst secondly the discriminative system aids continuous order in and sorting of sensory stimuli (Leornard, 1986, page 19). Tactile perception was viewed as one of the essential conditions for visual perception. Kannegieter noted that tactile perception enhances spatial interpretations in pre-academic activities (shape discrimination) and discrimination among objects. Another theorist reported that it also aids eye-hand performance by providing correct pressure on writing instruments (Leornard, 1986, page 20). Similarly, Kephart (1971) found that a fully functioning tactile system aids in planned purposeful movement as in writing.

Haptic perception, which is part of tactile and kinesthetic function, is defined by Gibson as 'active touch' which 'involves concomitant excitation of receptors in joints and tendons along with new and changing patterns in the skin. Passive touch, however involves only slight excitation of the receptors in the skin and underlying tissue. Brazelton suggested that, whereas passive touch may add to an infant's ability to initiate and maintain control, active touch acts as an alerter and as information. It helps the infant come to a receptive alert state and begin to process information (Henderson and Pehoski, 1995). Haptic perception allows children to gain recognition of common objects and shapes, discriminate texture, size and weight of the objects and recognize spatial orientation of objects. Research indicates that an association between tactile perception and higher level cognitive processing exists and becomes stronger with age. Studies show that good tactile discrimination was found to be associated with reading skill and cognitive problem solving ability in the older age group. Review of the literature indicates that impairment in somatosensory processing, manual and in hand manipulation, vision, visual perception or cognition, can contribute to deficits in haptic perception (Henderson and Perhoski, 1995).

Visual System

Post stimulation, the retina of the eye, a receptor sensitive to light waves in the environment sends impulses to both cerebral hemispheres. The impulses are processed, refined and integrated, sometimes with other types of sensation. Proper functioning at all levels of the brain and integration of many types of sensation with visual input are necessary to give the child accurate, detailed visual perception and eye-hand coordination (Ayres, 1981, 1972). The following levels

come together when the four senses are integrated into the body percept, coordination of the two sides of the body, motor planning, attention span - Refer to the Figure II. Emphasis shall be made on the skills pertinent to the study.

Body Perception

Fisher et al. (1991) through their research noted the important role of vestibular proprioception of their subjects' body in space, particularly for movement.

Coordination of Two Sides of the Body

This is bilateral integration, which involves the ability to use two sides of the body together in a coordinated manner.

Laterality also affects bilateral integration to a certain extent. Laterality refers to the degree to which either sensory reception or motor output on one side of the body is superior to the reception on the other side (Fisher et al. 1991). Lerner, (1985) describes laterality as the awareness of the two sides of the body, and the ability to identify them as left or right correctly. Some theorists suggest that lateral dominance is linked to cerebral dominance (Williams, 1983). Examples of coordinated tasks include walking in a straight line, hopping, kicking and catching a ball (Cratty, 1970 and Williams, 1983).

Motor Planning

Motor planning or praxis is the ideation, as well as the programming and planning necessary for the execution of a new skilled purposeful movement. This could involve activities like picking up a pin, playing football and typing. Once the skill has been learned, it no longer requires motor planning or conscious attention (Arnadottir, 1990 and Ayres, 1981).

Activity Level

In order for the child to engage in a task, the child must be able to stay cognitively and motorically fixed. It is assumed to be related modulation in all sensory systems, where a high activity level is very functional and productive if it remains focussed (Kramer, 1993).

Attentional Level

Moderate attention is required to interact efficiently with the environment which will facilitate education. Overactivity leaves the child deficient in his ability to screen out enough pertinent information to attend to the important things and under activity leaves the child with inadequate arousal for input to which he should respond (Kramer, 1993, page 102).

Visual Perception

For clarity, three definitions of visual perception shall be first discussed.

According to Gardner (1982, page 8), visual perception is defined as 'the ability of the brain to understand and interpret (make sense) what the eyes see, and based on understanding and interpretation, it is the ability to express the meaning verbally or motorically'.

Visual perception may be viewed as one aspect of the total sensory perceptual development of the young child. Sensory perceptual development, generally has to do with the refinement of the sensory process that allows the child to steadily improve his ability to pick up, process, and evaluate more complex qualities of sensory information. Hence sensory perceptual development is critical to age related changes in the ability of the child to pick up or take in information from the external and/or internal environment (Williams, 1983, page 68).

Kramer (1993, page 178), defines visual perception as an interactive product that involves the reception of input through the visual system, intersensory integration of that visual input and cognitive analysis.

As researchers have proposed that perceptual and motor tasks are autonomous systems, they shall be discussed separately, but under visual perception.

Eye Motor Control

This is the ability to coordinate or regulate the ability of the eyes and hands together in efficient, precise and adaptive movement patterns.

There are various types of visual perceptual abilities, which shall be discussed below:

Visual discrimination

It is the ability to differentiate to varying degrees of precise similarities or differences in the characteristics, arrangements, sequencing and/or organization of single or groups of visual stimuli.

Figure-Ground Perception

This deals with the ability to extract relevant or pertinent detail from context that contain irrelevant or distracting information (Williams, 1983).

Visual Closure

Visual closure involves the ability to recognise a visual whole from the presentation of a part or of mutilated parts (Leornard, 1986).

Spatial Relations

Lerner (1985), described spatial relations as the perception of position of objects in space.

Position in Space

This involves the discrimination of reversals and rotation of figures (Gardner, 1982).

Form Constancy

Involves the recognition of dominant features of certain figures or shapes when they appear in different sizes, shading, textures and positions (Gardner, 1982).

Visual Memory

As visual information is received by a child, it is compared and contrasted with previously experienced information that has been stored. Visual memory is the ability to retain and recall past visual experiences (Kramer, 1993, page 183).

Visual Sequential Memory

It is the ability to retain and recall information in particular categories or sequences (Kramer, 1993).

At this end stage everything comes together to form the functions of the whole brain, being the end products of every sensory process.

2.2.4. OVERVIEW OF PERCEPTUAL DEVELOPMENT

The processing of perception is initiated during foetal development and progresses onto late

childhood and even early adulthood (Ayres, 1981 and Williams, 1983). Lerner (1985), notes that certain characteristics, of the individual, assume greater prominence at certain age levels.
This section emphasizes the development of visual perceptual skills relevant to the study.
According to Ayres (1981), and other theorists, the integration of the senses are a prerequisite to providing the foundation of the performance of perceptual and motor tasks.
Ayres (1981), contends that the brain at birth already knows how to integrate a few basic tactile, vestibular and proprioceptive sensations which are used when responding to stimuli. As the child interacts with the environment, parts of the senses become more refined.

Early academic learning is dependant upon the organization of the sensory input. If these sensory systems do not work well, visual processing may be more difficult (Ayres, 1981, page 102). Williams (1983), contends that the integration of visual and auditory stimuli greatly improves by seven years and continues to mature until eleven to twelve years. Visual-tactile /kinesthetic integration abilities also continue to improve and mature until eleven to twelve years of age.

Research indicates that *haptic perception* improves with age and continues to mature into adolescence. Like adults, children show greater left than right-hand skill in some forms of haptic perception, possibly reflecting specialization of the right hemisphere for processing of spatial information.

Children tend to follow an identifiable pattern when acquiring *balance*. Studies indicate that balance performances improve with increasing age from three to nineteen years. Age-related changes in balance performance are more gradual for some tasks than others, for instance, a child can walk a line heel to toe for a short distance and at four skilful jumping is apparent. Although some research indicated some sex differences with regard to balance, their precise nature appears unclear (Williams, 1986 and Cratty, 1970).

Eye movements show adult characteristics at six to eight years. Other studies show more rapid development of visual and visual motor integrative abilities between five and eight years (Hudgins, 1977 and Zietschel et al. 1979).

Generally children show the most improvement in fine motor tasks from four to six years, whereas more complex ones tend to improve gradually from five to twelve years (Williams, 1983). According to Williams (1983), children in general show rapid development in visual perceptual skills from three to six years. Visual information processes improve markedly from six to ten years, and visual memory increases in a linear fashion from seven to twelve.

Studies indicate that from five to six years, figure-ground perception increases rapidly; whereas spatial relations undergo rapid growth from five to seven years. Development of visual closure occurs gradually from four to nine years. Perception of depth and movement reach maturity between eight and twelve years. Static visual acuity reaches maturity at ten years, whilst dynamic acuity at eleven to twelve years.

Belka and Williams (1978), through their research, reported that the kind of visual perceptual ability that is important in cognitive development, changes with the age of the child. Furthermore, Ayres (1981) reports that as the child grows older, he learns 'splinter skills', in order to compensate for any poor sensory processing skills he may have.

2.2.5. PERCEPTION AND PERFORMANCE

This section views literature on perception (motor and non motor), and learning /academic performance. Research studies focussing on the perceptual assessment batteries used in the study will be discussed.

Although visual perceptual abilities are crucial to the development of cognitive abilities like reading, the exact role of visual perception is not completely understood. With respect to perception and academic skills, Kephart (1971), asserted that perceptual motor skills such as drawing and copying does have a bearing on academic achievement.

Madge in Vorster and Brand (1995), supported this by noting that there is a significant relationship between performance in the copying of figures and general scholastic performance.

Various studies indicate that for six-year-olds, visual perceptual abilities are very important in learning of gross perceptual motor tasks. It was concluded that children with advanced visual perceptual abilities began and maintained a higher level of performance throughout the learning period (Williams, 1983).

According to Vorster and Brand (1995), several researchers state that visual motor integration has a definite influence on a child's ability to master reading, writing and arithmetic skills at school entrance levels. Some studies showed that scores on the VMI Test correlated with academic performance. Other studies indicate significant correlations between VMI test performance and achievement in reading and mathematics. Research on the use of the VMI test in South Africa offers conflicting findings (Helm and Concha, 1990) and that it must be used with caution (Vorster and Brand, 1995). A study in East Rand, South Africa indicated low correlation between handwriting and academic performance on the VMI test (1982) and DTVP(First edition). The sample included only South African urban children four to fourteen years of age (Helm and Concha, 1990).
Leornard (1986), reported that no specific norms for gender were required for the VMI test and the MFPT, as reported in previous studies.

Research by Jordan and Jordan (1990), indicate that through the use of Jordan's Left-Right Reversal Test , indicates that there is a connection between reversals and reading problems.

According to Williams (1983), during the early developmental years, fine-motor control behaviours seem to be significantly related to several other dimensions of growth like gross motor control and certain cognitive behaviours. Studies indicate that motor control and coordination gained during preschool years are basic to the child's school tasks of reading, writing and logical thinking (Palmer, 1970; Mchale and Cermak, 1992).

The child with problems in bilateral motor integration would experience difficulty in writing. On paper and pencil tasks the child would produce reversals/ mirror image letters or numerals, and be unable to change strike direction in a continuous flow pattern. He also would not be able to stabilize the paper with the non dominant hand when writing and colouring (Henderson and

Pehoski, 1995). Ayres (1989) noted that such deficits (bilateral integration) were linked with deficits in sequencing (Fisher et al.1991).
Ayres (1972), Fisher et al. (1991) and Williams (1983) have reported that various studies show the relationship between learning disability and eye-hand dominance, probably being present in some children. Ayres also included ear and foot dominance.

According to Ayres (1981), children with overall poor sensory integration cause them to become slow learners or to have behavioural problems. Several studies indicate that impairment in tactile and kinesthetic perception has been cited in children who display learning disabilities and related disorders. Poor tactile and kinesthetic perception had been found in children with language disorders, dyspraxia and others (Henderson and Pehoski, 1995 and Ayres, 1981). Some studies, however, did indicate that the discrepancies in intra sensory integration abilities of normal and slowly developing children are not as great as they were once perceived to be (Williams, 1983).

There is still, however, limited literature available on the administration and outcome of the revised editions of the various perceptual batteries administered in the South African context.

2.2.6. VISUAL PERCEPTION AND OBSTETRIC BRACHIAL PLEXUS PALSY

There is no literature available on visual perception in OBPP.

A point of departure would be to consider the theories of perceptual development and it's application in this regard. Livingstone (1978, page 38) stated that 'the child's growing sensory system is calibrated to it's growing motor system from the onset'.

The visual system has neural interconnections with all other sensory systems. Clusters of interconnections or synapses grow between these neurons during infancy. As the baby interacts with the world and the parts of his body, the sensory and motor impulses flowing among the neurons cause the fibres to grow branches reaching out towards other neurons. The growth of new interconnections produce new possibilities for neural communications, adding new elements to the infant's sensory perceptions and motor abilities. By the age of ten the growth and sensory

interconnections are complete or nearly complete in most parts of the brain (Ayres, 1981).

The OBPP child may have a complete or partial lesion of the plexus. As reported by Henderson and Pehoski (1995) disruption of the communication anywhere within the somatosensory feedback mechanism, would result in the loss or impairment in the ability to explore objects with the hands. Hence, one may postulate that the accuracy of the interpretation of the information at higher cortical levels of the OBPP child, using the motor and sensory affected upper limb/s is/are questionable. A study conducted by Boyer (1911), on the examination of the nervous system of an unusual OBPP patient with a root lesion, indicated cell destruction of the intermediate precentral area of the middle motor cortex of the left side, as the contralateral limb was affected. This area, as noted by Arnadottir (1990), is representative of the [6]homonculus, which provides sensory and motor distribution of major parts of the body. Interestingly in this area, as noted by Brodman in Boyer (1911) and Arnadottir (1990) there is a very large representation of the upper limb; being the centre for refined movements of the hand.

Ayres (1981), Fisher et al. (1991) and other investigators hypothesized the importance of the processing of the tactile system information for the development of an adequate body scheme, which is critical for motor planning. Results from a study on visual perceptual testing on physically disabled children indicated that the severely disabled scored lower than the mildly disabled, who in turn, scored lower than the non-disabled (Zeitschel et al. 1979). OBPP is commonly referred to as a physical disability.

Various studies have shown that the ability to perceive the external world, as well as our bodies are crucial for well coordinated reaching movements. Disruption of this perception in motor impaired children showed a greater severity of dysfunction in well coordinated reaching movements than for normal children (Henderson and Pehoski, 1995). Williams (1983), who noted that bilateral motor coordination begins with the child's attempt to move the arms bilaterally in a crude fashion on either side of the vertical midline of the body. The OBPP child, with a motor and sensory deficit of the limb/s, is likely to present with impaired bilateral upper limb movements. This is likely to be influenced negatively, should the child present with poor bodily

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[6]Homonculus

perception of the external world. One may infer that the unaffected limb is likely to interpret sensory and motor information more accurately.

On the contrary, however, there has been research supporting the premise that visual perception and motor development are considerably autonomous systems (Harber, 1979). A study by Newcomer and Hammill (1975), on children with motor impairments indicate that performance is appropriate on a motor free test of visual perception, but is however progressively poorer on a test on VMI, regardless of the level of motor ability. A study conducted by Kopp and Shaperman (1973) to assess the cognitive development in the absence of object manipulation of a child born with complete absence of the upper limbs, showed the following results. Components of the Stanford Binet Intelligence Scale was used, with the results indicating that on most of the items, the child showed intellectual functioning at or near the age level. This study, however did present with shortcomings, as the formal testing was initiated three months after the child had received a prosthesis, posing the possibility of acquiring his skills during this period. The child was surrounded by a positive environment, hence encouraging the volitional status, which in turn impacted on the performance subsystem. Performance on motor and non motor tests, as well as bilateral motor integration were not performed. Nevertheless, this casts a doubt on the traditional way in which the child learns through manipulation of objects with concurrent integration of the senses.

In a study by Prechtl et al. (1997), the spontaneous movements of normal and abnormal infants, between the ages of six to twenty weeks, were assessed. It was found that a poor quality of general movements followed in neurological abnormalities, whilst normal general fidgety movements followed a normal neurological outcome. This research opens the door to questions like:
Does the outcome of the study mean that infants with poor general movements of the upper limb following OBPP, have poor neurological outcome?

The Candidate found that a certain number of OBPP children expressed a desire to use their affected limb on initiation of a task. However, during the course of engaging in the task, the motor impairment of the limb alerted the child to inefficacy of the limb. Subsequently the OBPP

child used the unaffected limb. This is likely to present some confusion in the child as to the dominant and non dominant hand.

Cross cultural studies put the incidence of right-handedness at about 90%. It has been postulated that left-handedness is very common in children with learning disabilities (Springer and Deutsch, 1981). OBPP children have either or both upper limbs affected. Review of the literature on hand preference indicate that the aetiology remains uncertain. There has, however, been various theories postulated: - those being genetic, social conditioning, altered brain development, brain injury or physical trauma at birth resulting in pathological handedness (O'Callaghan et al. 1993; Springer and Deutsch, 1981; Molfese and Segalowitz, 1989). A study by Umansky (1974) to demonstrate the traumatic peripheral interference on the hand, is an example of pathological handedness - postnatally. Placing a sock on one forearm of four to twelve-month-old infants, resulted in rapid disuse, not only of precision but also for reaching which was not mechanically hindered by the sock. It was concluded that the relatively minor peripheral disability provided a potential behavioural parallel of neurological dysfunction in infancy (Springer and Deutch, 1981). Hence OBPP, which results in peripheral disability of the upper limb/s, may also present with a clinical picture of neurological dysfunction, somewhat supporting Prechtal's (1997) findings.

Fisher et al. (1991), following a literature review, rejected the theories proposed by Delecato, Kephart and Orton, all of whom assumed that the early concept of cerebral dominance (that is dominance for hand, foot, ear and eye) should be all consistent. Other investigators also reported no evidence for eye preference. Little correlation between eye and hand preference in the normal population was found, indicating that crossed dominance is not dysfunctional. Fisher et al. (1991) reported that motor control of most movements are bilateral that is both ipsilateral and contralateral. Only the refined finger movements are under the control of the contra lateral hemisphere, providing the exception to this rule. The outcome of the study is likely to reveal interesting contributions in this regard.

Hence, although there are various contentions on laterality and hemispheric specialization, the basic notion that poor visual motor integration and lateral preferences contribute towards writing and reading disabilities, are accepted (Annett1970; Springer and Deutsch.1981; Ayres, 1981,1972;

and Fisher et al. 1991). Ayres (1976), indicated an association between a right ear advantage on dichotic listening tests and measures of auditory language abilities. Other researchers, however, have contested these findings (Fisher et al. 1991).

The incidence of birth asphyxia and related complications is one hundred and forty per one thousand births for deliveries with shoulder dystonia, as compared to fourteen per one thousand births for all deliveries (Stephen et al. 1991). According to Shah (1991) in the Bulletin of the World Health Organization, birth asphyxia and birth trauma are the leading causes of mental disability in the developing countries. Hence, the likelihood of an OBPP child being born with asphyxia and having a mental disability does exist.

Various deductions on the performance of OBPP may be postulated following similar abilities and disabilities, from the available research. Much research points to the likelihood that OBPP children are likely to have neurological /mental deficits, implying poor visual perceptual abilities. On the other hand, some research contends that perception and motor function are autonomous systems, hence showing no relation between the two.

2.2.7. THEORETICAL OCCUPATIONAL THERAPY APPROACH

Although an eclectic approach is used in the study, the primary focus of the study is on the Model of Human Occupation.This model, being an occupational therapy model, presents a good holistic approach when viewing the disabled.

Model of Human Occupation

The [7]occupational behaviour of the child can be represented as an open system, energised by an urge to explore and master the environment. It is composed of three subsystems and their

[7]Occupational Behaviour

components; namely [8]volition, [9]habituation and [10]performance (Kramer, 1993).

The application of OBPP to these subsystems, with reference to Keilhofner (1985), may be interpreted to as follows:

OBPP primarily a physical disability, affects the volitional subsystems. It reduces to some measure the child's motivation to explore and gain mastery in the environment. It would prevent him from engaging in a variety of activities like volleyball and cricket, depending on the level of the lesion. Contrarily, however, the familial and cultural expectations may influence the child positively. This would encourage greater choices and experiences, thus stimulating the urge to explore and master the environment despite the disability.

With reference to the habituation subsystem, it disrupts and places new demands on habits, for instance, the manner of accomplishing daily routine tasks like self-care activities.

In terms of the performance subsystem, there are decreased opportunities for the child to explore in the environment, often leading to distorted perceptions and limited information about the world.

The study emphasizes the performance subsystem, particularly perceptual motor and processing skills. Hence the model assists with the assessment, an understanding of the assessment process and why it is done, as well as treatment (Krefting, 1985).

It must be noted, however, that the model also has shortcomings. It does not appear to emphasize the innate ability/volition in children in coping with certain disabilities, for example the ability of a child with congenital absence of both hands, to manipulate and write with a pen using his forearms without therapeutic intervention. (Case observed at the Orthopaedic Clinic at King Edward VIII th Hospital).

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[8]Volitional Subsystem

[9]Habituation Subsystem

[10]Performance Subsystem

2.2.8. PERCEPTUAL ASSESSMENT

Assessment as defined by Thomas et al. (1987) is the complex and individually specific process of gathering information in order to identify areas of strengths and weaknesses and to interpret the findings for effective programme planning.
Assessment with reference to the Model of Human Occupation, encompasses the child's performance abilities including his habits, roles, motivation, competence and achievement behaviours. Observation of the child's interaction with the environment is also considered.
The competent therapist, in administration of the assessment battery, must be able to select appropriate tools (Kramer, 1993; Thomas and Hacker, 1987). Emphasis shall be placed on the perceptual motor skills within the performance subsystem.

According to Hammill et al. (1993) a comprehensive evaluation of a child's visual perception should include assessment tasks that are exclusively visual perceptual (requiring little or no motor abilities) and tasks that involve visual motor integration (VMI), or visually guided motor behaviour.

Some of these assessment batteries are; DTVP(1993) and TVPS(1992, 1982). The choice of the assessment battery is very important as it must have certain characteristics. The test must first be valid; hence giving a true measure of the skill/behaviour/characteristics being tested which is content validity (Thomas and Hacker, 1987). The second component of validity is criterion related validity, which involves relating scores on some measurement device to another indicator of performance. The third component, construct validity, evaluates the extent to which the test measures a theoretical construct or trait that is presumed to be an underlying determinant (Leornard, 1986).
The second characteristic is that the test should be reliable in terms of what is being measured (Thomas and Hacker, 1987).

Hammill et al. (1993) supported by Salvia and Ysseldyke commented that the tests of visual perception today are seriously flawed. It was noted that their normative data was based on a non-representative sample, reliability coefficients were too low, and the validity work too

sparse to engender confidence. Professionals need well-constructed tests of visual perception. Research indicates that some of the most popular tests are the VMI Test (1989), DTVP(second edition), TVPS, MFPT and Ayres Clinical Observations (Hammill et al. 1993 and Roger, 1994).

Thus it appears evident that the choice of the assessment battery and the expertise of the examiner are crucial for effective evaluation of performance.

CHAPTER 3

METHODOLOGICAL CONSIDERATIONS

3.1. METHODOLOGICAL PARADIGM

Polit and Hungler (1991), noted that there are major advantages in working with a quantative method. These include the fact that:
Quantification enhances objectivity, as it permits observation to be independently verified by other researchers;
Quantitative measures make it possible to obtain reasonably precise information and,
allows for uniform communication of information to a broad audience of people.

A quantitative method was used in this study, as an objective method. This involved the use of a structured questionnaire, which was administered to the parents. The Questions were categorically grouped in order to elicit background information on the child. Standardized assessments and screening batteries in a structured environment were administered to the sample. The sample consisted of thirty children with OBPP, between four and seventeen years of age. Observations were noted and categorized. The OBPP children were assessed to elicit visual perceptual abilities as well as the level of lesion of the brachial plexus injury.

3.2. RESEARCH DESIGN

A descriptive and correlational design was used. Measures of visual perceptual ability shall be described. This included areas of visual perception in which the OBPP children have performed significantly poorly and well. The overall visual perceptual abilities were correlated to the severity of the lesion of the OBPP child, to ascertain whether the more severe the OBPP lesion, the more severe the visual perceptual deficit. Tests assessing similar abilities, like Motor tests were correlated to assess its validity.

The extraneous variables which were controlled by keeping them constant were:

1.Diagnosis

Only subjects diagnosed with OBPP by the Orthopaedic surgeon were used in the study. Subjects with unclear diagnoses like cerebral palsy and polio were only excluded. The medical history was obtained from the patient's Medical Files.

2.Age

Subjects between the ages of four to seventeen were included in the study. (This variable will also be discussed under the limitations of the study).

3. Assessment Venue

Although four assessment venues were used, attempts were made to ensure constancy by, the following:

the testing environment had to be pleasant, well illuminated, free of distraction, noises and interruption.

4. Tester

All the assessments were executed by the Candidate in order to ensure objectivity throughout the study.

3.3. CRITERIA FOR SELECTION OF SAMPLE

SAMPLE

The subjects comprised of 30 OBPP children, residing in the Kwazulu Natal area. Their ages ranged from four to seventeen years of age, with fifteen being male and fifteen females.

The distributions in accordance with the race and gender of the subjects were as for Table I.

TABLE I

Race and gender distribution amongst subjects

RACE - PERCENTAGE(n)				GENDER - PERCENTAGE(n)		
Black	-	43,3% (13)		Male	-	50% (15)
Indian	-	53,3% (16)		Female	-	50% (15)
White	-	3,3% (1)				

Key:

(n) - Number of subjects

Table I indicates that most of the subjects were Black and Indian. There was equal numbers of male and females.

3.4. MEASURING INSTRUMENTS

A structured questionnaire, and a number of assessment batteries were administered.

- Criteria used for Selection of the Test Batteries:

A number of criteria were used in the selection of the appropriate test batteries.
A wide age range of subjects was used, hence the need to use the various batteries to accommodate this. Validity and reliability of the tests had to be met.

General visual perceptual tests were used. Tests which incorporated assessment of laterality (Jordan's L-R) and bilateral motor integration (VMI Test, Clinical Observations) were specifically included in addition to the general visual perceptual assessments. This was important to ascertain the likelihood of any deficits in such areas. The link between laterality, bilateral motor integration with OBPP has been discussed in the literature review, Chapter 2.

Interpretation of test results recommends that tests should not be used in isolation, but together with other visual perceptual tests. The Candidate was also familiar with the administration of the tests and the individual tests were not time consuming. No norms were available on the tests chosen for the South African population. The tests were chosen as they were developed on an unbiased sample.

The assessment batteries shall be described first. A tabulated display of the tests used, is presented on the following page.

TABLE II

SCREENING / ASSESSMENT BATTERIES

MEASURING INSTRUMENT	ABILITY MEASURED
Developmental test of Visual Motor Integration (1989)	Visual Motor Integration
Developmental Test of Visual Perception - second edition	Visual Motor Integration Motor Reduced Visual Perception Overall Visual Perception
Motor Free Perception Test	Motor Reduced Visual Perception
Test of Visual Perceptual Skills (Upper and Lower level)	Motor Reduced Visual Perception
Jordans Left-Right Reversal Test	Visual Reception for Letter and Number Reversals
Detriot Test of Learning Abilities (3 Subtests)	Visual Perception-Motor and Non Motor
Clinical (Ayres) and General Observations	Screening of Sensory Integrative Abilities

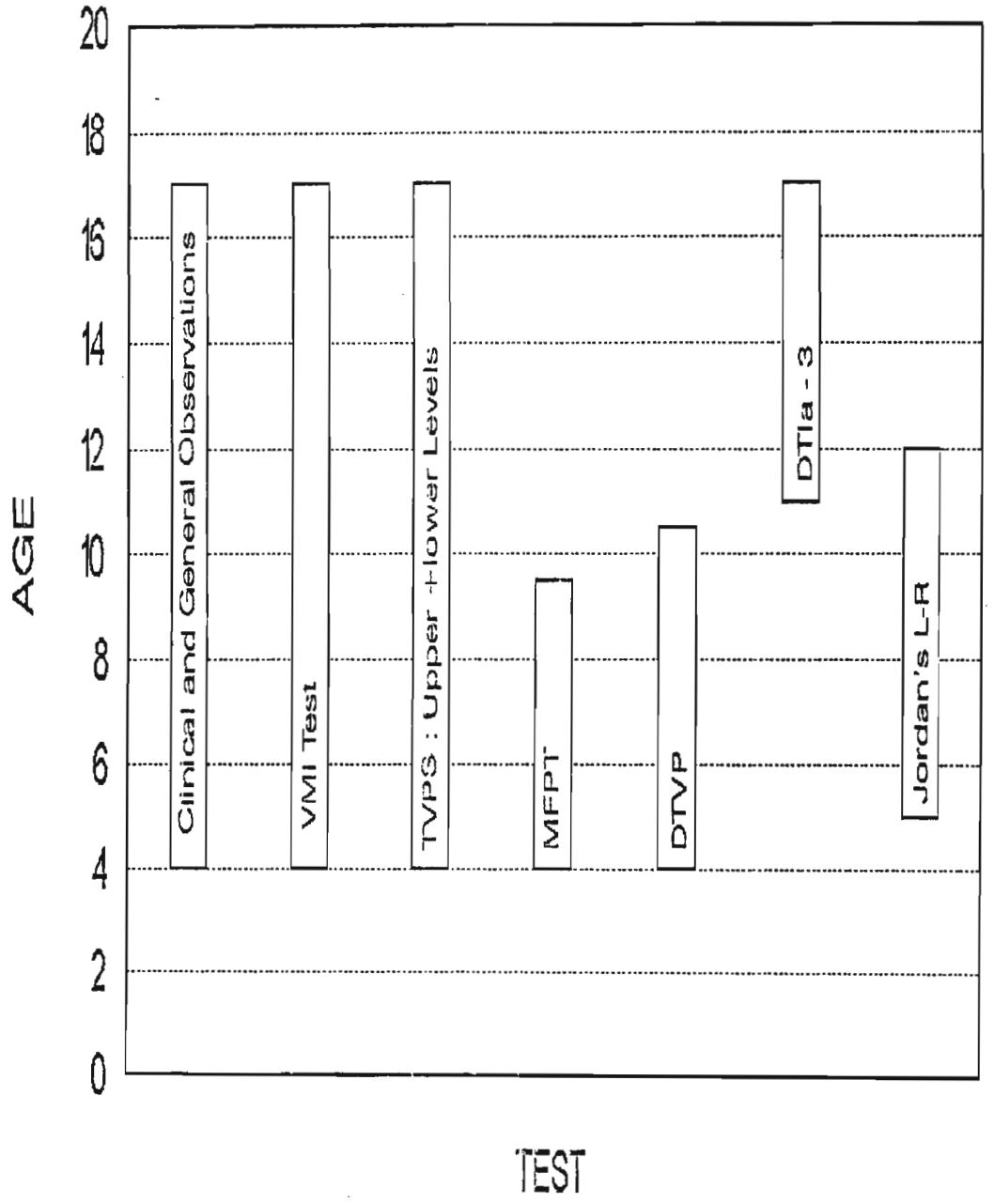
The Table indicates the various screening/assessment batteries/instruments administered to the subjects, and the ability measured by the batteries/instruments.

In addition, the reader is requested to Refer to Figure III, page 33, which indicates the visual perceptual tests against age group classification.

It must be noted that all the tests have instructional manuals on administration and interpretation, and hence must be used in conjunction with them.

FIGURE III

Visual Perceptual Tests against Age Group Classification



Key:

Dtla - 3 - Detroit Test of Learning Aptitude (3 Subtests)

3.4.1. Developmental Test of Visual Motor Integration - VMI (1989)

The test is a test of visual motor ability of individuals three to nineteen years of age. It consists of twenty four-geometric forms arranged in a developmental sequence, which the subject has to copy. The norms for this third edition were based on a representative sample, of the United States population, being inclusive of different ethnic groups, socioeconomic levels, residential areas and sex. Interrater reliability was high, with the test retest median being, 81. Internal validity of the VMI Test tended to correlate well with arithmetic and reading. Research by Lyon and others have indicated that VMI Test is an effective measure for differentiating subtypes of learning disabilities (Beery, 1986).

3.4.2. Developmental Test of Visual Perception - DTVP (2nd edition)

The DTVP is a battery of eight subtests that measure different but interrelated visual perceptual and visual motor abilities. The subtests were eye-hand coordination, position in space, copying. figure-ground, spatial relations, visual closure and visual motor speed. The test is designed for use of children four to ten years of age and has empirically established reliability and validity. The normative sample was based on a representative sample from different states in the United States of America.

The DTVP takes thirty to sixty minutes to administer. The response booklet is provided to the child, and with reference to the examiner's manual specific instructions are given to complete the pencil and paper component of the test. This component of the test measures the VMI composite, whilst the picture book which requires the child to point to a specific design, forms the motor reduced composite. The scores are recorded on the examiner's record form, and tabulated with reference to the manual.

3.4.3. Motor Free Perception Test (MFPT- 1972)

The MFPT is a test of visual perception which avoids the motor involvement, being practical for screening, diagnostic and research purposes. Calarusso (1972) reports that the test is a quick,

highly reliable and valid measure of overall visual processing ability in children. The five categories of visual perception included in the test is spatial relations, figure-ground, visual closure, visual memory.

It is a thirty-six-item test, individually administered, multiple choice test. The response required from the subject is that he or she must point to one of the four alternatives that he or she feels is the correct response. The examiner scores the subjects response by marking the appropriate space on the accompanying scoring sheet.

3.4.4. Test of Visual Perceptual Skills (1982-TVPS-Lower Level) and Test of Visual Perceptual Skills (1992-TVPS-Upper Level).

The TVPS determines the child's strengths and weaknesses based on non motor visual perceptual testing. The TVPS-Lower Level caters for children four to twelve years, whilst the TVPS (Upper Level) caters for the twelve to eighteen years age levels. The seven subtests include;

1. Visual Discrimination
2. Visual Memory
3. Visual Spatial Relations
4. Visual Form constancy
5. Visual Spatial Relations
6. Visual Figure-Ground
7. Visual Closure

Crowe et al. (1993), noted that reliability scores on the TVPS (1982), as a whole, showed an adequate test retest reliability.

TVPS is a non language test and is not biased according to race, sex or education. With reference to the letter written by Gardner (1996), who suggested that the TVPS (Upper and Lower levels) being a non biased test would be appropriate for Black South African subjects. Refer to Letter, Annexure I.

Like the MFPT, the TVPS has to be individually administered and has more components than the MFPT. It would then be scored against the normative tables provided in the manual.

Gardner (1982,1992) maintains that both the tests have content validity and diagnostic validity in assessing specific deficits of visual perception. Crowe et al. (1993), however, maintained that the subtest scores showed low test, retest reliability thus indicating that the subtests scores should be used with caution.

In terms of criterion related validity both tests show a moderate to low relationship with intelligence tests. Gardner (1982,1992) proposes that as the scores indicate that there is a relationship between visual perception and intelligence, the TVPS addresses aspects that are not addressed in the other tests.

3.4.5. Jordan's Left-Right Reversal Test (Jordan's L-R)

The test specifically measures letter and number reversals in the area of children's visual receptive functioning, with the ages being between five and twelve. The test is divided into Level I for children five to eight years, and Level II for nine to twelve years. The test may be administered in a group or individually. Level I involves the child identifying letters and numbers that are reversed, whilst Level II involves identifying words and sentences with reversals. The normative tables are arranged for sex and age, based on children with average IQ 85 and above.

The sample was representative, being non biased in terms of socioeconomic status and backgrounds.

Jordan (1974), proposed that the test is a good diagnostic tool for learning disability as visual reversal has been commonly accepted as one of the constellation of symptoms of minimal neurological impairment in children.

Research indicates a correlation between perceptual motor scores, visual reversals and reading, hence indicating decreased perceptual motor scores results in a reciprocating effect in other

scores. Children diagnosed as having minimal neurological impairment scored significantly higher (Meaning that they presented with more errors) than normal children. All reliability coefficients of the test were significant, and the test showed substantial validity (Jordan, 1974).

3.4.6. Detroit Test of Learning Aptitude - 3(DTLA-3)

DTLA-3 is a battery that measures a variety of developed abilities. It consists of eleven subtests that measure different but interrelated mental abilities and must be individually administered. It is designed for subjects, six to seventeen years of age and is reliable and valid.

Hammill (1991), stated that the test was designed in order to minimize cultural and social bias. Depending on the orientation on of the needs of the test user, DTLA-3 results can be used to estimate general cognitive functioning(Intelligence), predict future success(Aptitude) or show mastery of particular content and skills (Achievement).

The subtests were carefully chosen to cater for the variety of subjects used in the study. Subtests that involved the least amount of language was chosen, not time consuming, motor and non motor components were chosen to supplement the DTVP as it was administered on children between eleven and seventeen years of age.

The subtests assessed were ;

a) Design Sequences

This measures visual discrimination and visual memory for non meaningful and graphic material and, to a lesser extent, motor control. The subject had to arrange cubes according to a particular design that was shown (Hammill, 1991). Salvia and Ysseldyke in Hammill (1991) note that the cognitive abilities assessed in this subtest are motor, sequencing and memory.

b) Design Reproduction

The subject was shown a design which was subsequently removed from their view and following a time lapse the subject had to draw the form. This subtest measures discrimination, motor, detail recognition and memory abilities (Hammill, 1991).

c) Picture Fragments

Parts of a picture were shown to the subject and this had to be identified, hence assessing pattern completion/ visual closure (Hammill, 1991). It must be noted that the composite scores have more confidence than the subtests, although both show good reliability. Studies show strong support for content, criterion related and construct validity. Evidence suggests that the subtests do measure cognitive developed ability (Hammill, 1991).

3.4.1. Clinical Observations(Ayres) and General Observations

Ayres (1972) proposed the use of clinical observations to supplement the information received from standardized motor tests like the VMI (Beery). Faris et al. (1992), noted that clinical observations were closely related to tests of cerebellar - vestibular function, or [11] soft neurological signs. Furthermore as noted in Chapter II, the integrations of the senses are a prerequisite for the refinement of visual perceptual skills. Hence the need to briefly screen the subjects using Clinical Observations (Ayres).

It must be noted that this test has limitations as a result of its objectivity, and it's reliability and validity have not been clearly established (Farris et al. 1992).

It must be noted that the Candidate is not a sensory integrative trained therapist. Not all items were used in the study as they are time consuming. Items assessing postural skills incorporating many of the reflexes were excluded. With reference to Clinical Observation of Motor and Postural Skills (COMPS), (Faris et al. 1992), items were carefully selected. Items focusing on bilateral motor integration were included.

The following observations as described in the Manual (SASI Research Committee, 1986) is noted in Annexure III. The observations were classified as follows:

a) Slow Movements

b) Diadokokinesis

c) Thumb Finger Touching

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[11] Soft Neurological Signs

d) Eye Preferences

e) Ear Preferences

f) Independent Eye Closure

g) Eye Movements

h) Cocontraction

i) Protective Extension

j) Throwing and Catching

k) Hopping

In addition to the above Clinical Observations (Ayres),

the following observation were also made (Refer to Annexure III, for detailed descriptions.) :

l) Dominance

m) Walking on a Line

n) Attention and Concentration

o) Understanding of Instructions

The observations were rated as either Normal, Mildly Deficient or Definitely Deficient.

The reader is requested to read through Chapter II (Sensory Perceptual Processing) for further background information.

3.4.8. Physical Assessment

TABLE III

Physical ability assessed and the methods used.

ABILITY ASSESSED	METHOD
Range of Movement (ROM)	-Observation -Passive Movements
Muscle Strength	- Muscle Strength Grading System (MRC) - Observation
Sensation	- Tactile sensory assessment and questions

Table III indicates the methods used for the assessment of ROM, Muscle strength and Sensation. The physical assessment took approximately ten minutes, per child. The results of the physical assessment were recorded on the Assessment form (Annexure IV) which also had the myotomes listed next to the nerve to assist with clarification. Please refer to Annexure III for detailed descriptions on the physical assessments mentioned on Table III.

Thereafter, each child's visual perceptual and physical assessment findings were recorded onto a form - *Summary of Occupational Therapy Assessment Findings* form (Annexure IV).
This facilitated computation by the statistician, as well as feedback given by the Candidate of the child's results to the parents.

Overall, the sample presented with majority being upper trunk lesions, and no lower trunk or total lesions.
The summary of the physical assessment findings in relation to age group classification, is as per the Table IV.

TABLE IV

Severity of lesion by age group classification

AGE GROUP (Year.Month)	UPPER TRUNK LESION (n)	UPPER/ MIDDLE TRUNK LESION (n)	LOWER TRUNK LESION (n)	MIXED LESION (n)	TOTAL LESION (n)	TOTAL (n)
4 - 8.11	6	3		4		13
9 - 10.11	4	2		2		8
11 - 12.11	1	2		1		4
13 - 17	2	1		2		5
TOTAL	13	8	0	9	0	30

Key:

(n) - Number of OBPP children

Table IV indicates classification according to severity of lesion and age group classification.

3.4.9. Parent's Questionnaire

Refer to the Annexure IV. A structured questionnaire, developed by the Candidate was administered to the parent/caretaker. The information obtained was important for the comprehensive evaluation of the performance of the assessment batteries.

The following information, using Hacker and Thomas's (1987) guideline on paediatric assessment was used:

1. Familial History, including incidence of learning problems in the family, as well as familial characteristics, like handedness.
2. Birth History, the type of birth and complications were important, as this was a birth injury.
3. Medical History, including any incidence like epilepsy, hospitalization etcetera.
4. Developmental History, the developmental progress of motor and other developmental milestones and the failure to progress is noted.
5. Educational History, of the child, focusing on any failures at school.
6. Medical Treatment received, including Occupational Therapy.
7. Socio-economic Status, This was calculated, as research had indicated that the socio economic status influenced performance (Griesal et al.1989). According to Brown and Wallace(1990), most Researcher's postulate that differences in the level of skills, exist amongst children from varying socio economic backgrounds. It is suggested that children from upper or middle class backgrounds perform at a higher developmental level than children from disadvantaged backgrounds.

In this study the occupation and education classification system, by Riordan, (1978) was utilized -refer to Tables XIV, XV, XVI (Annexure V). The total score derived from the occupation and education classifications from the father, provided the socio economic index for each subject, from which they were classified as being Upper, Middle or Lower Socio economic status, utilizing the cut off points as described by Riordan (1978) - Refer to Tables' XVI and XVII (Annexure V).

3.5. PROCEDURE

The study was conducted from March 1996 to July 1997. Letters (Annexure I) were forwarded

to all Kwazulu Natal Provincial Hospitals, and Therapy Centres which had Occupational Therapy and /or Physiotherapy services (Twenty-Six in total).

Occupational Therapists/Physiotherapists were requested to supply numbers of OBPP patients seen at their centre, as well as to request referral of such children for the purpose of the study. Response was poor, and of the eleven OBPP children referred, eight were agreeable for an assessment.

Letters were sent twice, to one hundred and three Parents/Caregivers whose children had previously attended the BP Clinic. None of the parents, however responded.

Twenty-two children who attended the Brachial Plexus Clinic at King Edward VIII Hospital were also included in the sample. Thirty OBPP children were assessed, of which twenty-five were assessed completely by the Candidate. The remaining five were lost to follow up.

The parents/guardians, of the subjects who had agreed to participate, were enlightened briefly about the study. Guardian/ Parental consent had to be given (Annexure II), to allow the OBPP child to participate in the study. Children treated at King Edward VIII Hospital were assessed at the Hospital. The OBPP children referred from other Institutions were given the choice of being assessed, at their institution, being Wentworth Hospital, Phoenix Assessment and Therapy Centre or R K Khans Hospital; at the Occupational Therapy Department or Physiotherapy Department, bearing in mind the criteria used for the assessment venue. A checklist was kept on hand to ensure that all the assessments were completed (Annexure III).

The parent's questionnaire was first administered. The assistance of an interpreter, who was familiar with the Questionnaire, was used for the parents of the Black children. The interpreter and the Candidate explained some of the items on the Questionnaire, to facilitate understanding and better interpretation of the questions.

Thereafter the tests were administered, in accordance with the age groups of the subjects. Each OBPP child was assessed in two/three one hour sessions. The tests were administered in a

specific order. A motor test was followed by a non motor test so as to reduce the amount of learning (retention) that may have taken place between the similar tests. The VMI Test was administered first. This was followed by the DTVP, DTLA - 3, MFPT, TVPS (Upper level), Jordan's L-R, TVPS (Lower Level) and, Clinical and General Observations. The latter was interspaced between tests when the child with OBPP presented with attention and concentration problems. Throughout the assessments, general observations were noted. The tests were marked according to the standardized norms. Using the normative data provided in the scoring manuals, the subject's performance was rated above average, average or below average. The supplementary physical abilities were assessed finally and the severity of lesion deduced.

The data was statistically analysed by a statistician from the Medical Research Council.
The cumulative percentage of subjects' scores were noted. Chi Square was most commonly used to assess significant relationships.

The following levels were applied, taking into cognisance sample size, to interpret the magnitude of the relationship was as follows;

		p	<	0,05	- indicated statistical significance
0,05	<	p	<	0,1	- borderline significance.

The Pearson Product moment correlation was used to determine the validity of the tests, by assessing the relationship between the non–motor tests; and the relationship between the motor tests.

Guilford (1946), suggested the following interpretations of the magnitude of the relationships.

Less than 0,20	- slight almost negligible relationship
0,20 - 0,40	- low correlation, definite but small relationship
0,40 - 0,70	- moderate correlation, substantial relationship
0,70 - 0,90	- high correlation, marked relationship
0,90 - 1,00	- very high correlation, very dependable relationship.

Performance on the tests, by the OBPP children were compared to the normal population, by using proportions presented on the Normal Curve (Lymen, 1986, page 82). With reference to the normal curve, it is accepted that the average population scores >16% and <84%; with below 16%

being below normal limits; and >84% being above average / above normal limits.This represents the cumulitive percentages in Diagram III below.

FIGURE IV

Distibution of the General Population under portions of the Normal Curve

(Adapted from Lymen,1986)

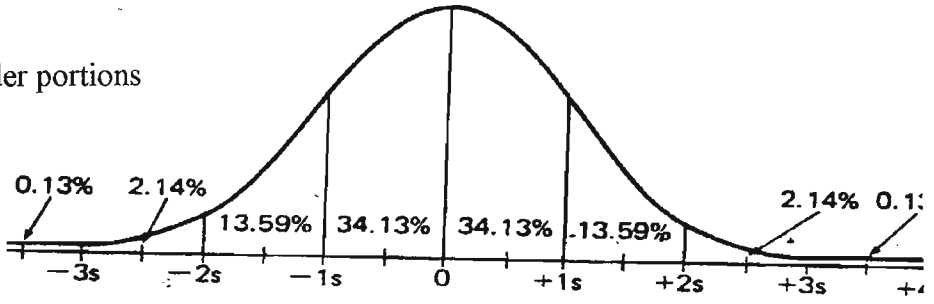


Figure IV represents the Normal Curve adapted from Lymen,1986 with the emphasis on the derivation of the cumulative percentages.

Additional information has been included (Annexure V), with particular reference to socio economic status, handedness, birth weight, asyphxia and developmental milestones, all of which may have affected the findings.

CHAPTER 4

RESULTS

4.1 RESULTS

The visual perceptual abilities of the OBPP children shall be described, in accordance with the Hypothesis.

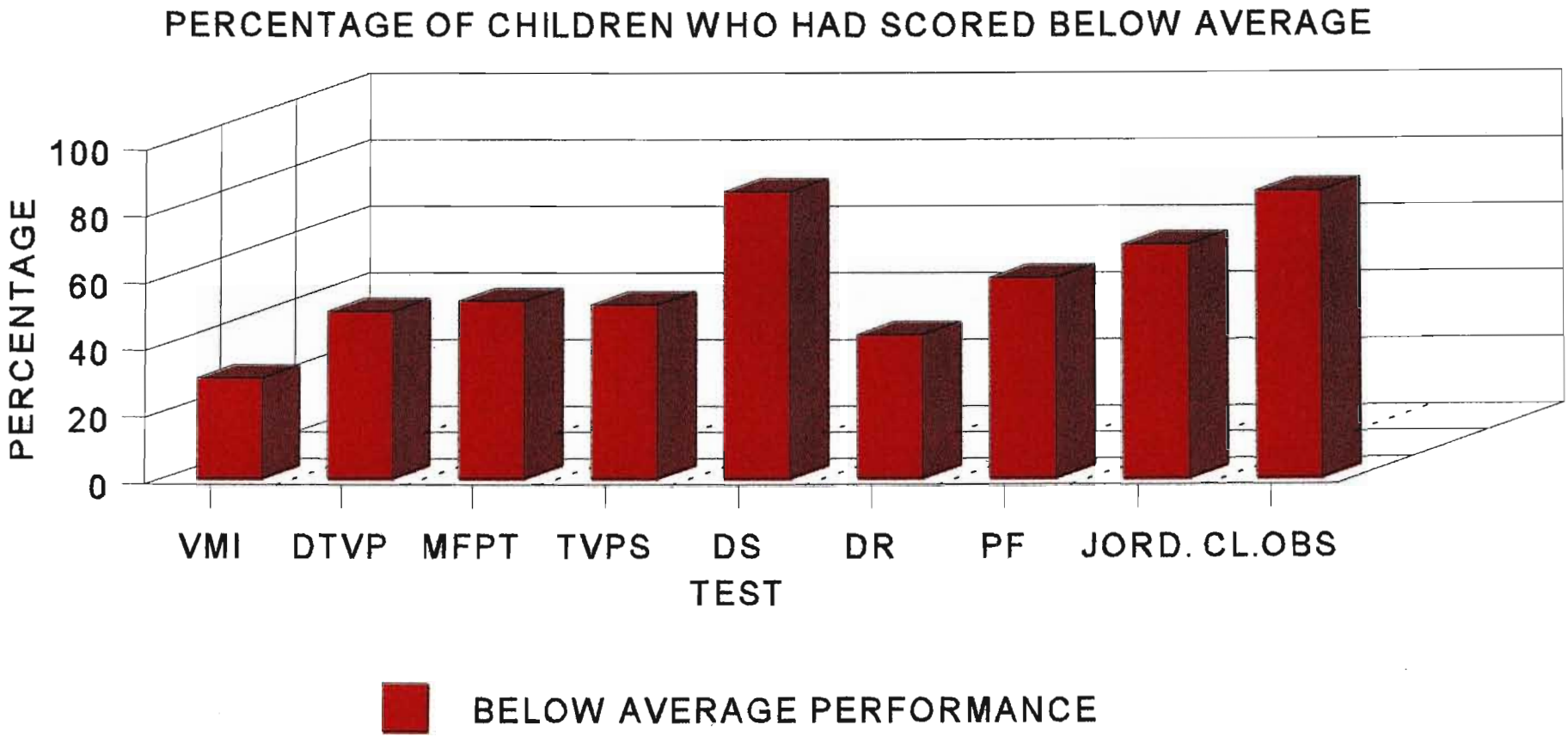
Null Hypothesis (1) : Children with OBPP have physical impairment only, and do not have impairment in visual/perceptual skills.

Alternate Hypothesis (1) : Children with OBPP have physical impairment, as well as significant impairment in visual/perceptual skills

It is an acceptable fact that OBPP, being an impairment of the brachial plexus results in physical impairment.

This hypothesis was assessed by considering the overal sample percentage who had performed below average on the tests, and correlating it against the percentage in the normal, population. The results pertaining to Hypothesis (1) shall be represented on the following Figure V and Table VI. It must be noted that slight and definite deficiencies were rated as below average performance on clinical and general observations.

FIGURE V



Key:

JORD. - Jordans Left Right Reversal Test

CL.OBS - Clinical and General Observations

TABLE VI

Association between below average performance in sample against normal population.

TEST	(%) SUBJECT n= a/b	(%) NORMAL POPUL-ATION	CHI SQUARE (p)	S/ B/ NS
VMI Test	30% n=9/30	16	0,22	NS
DTVP - General Visual Perception	50% n=10/20	16	0,02	S
-VMI	60% n=12/20	16	0,03	S
- MRVP	60% n=12/20	16	0,03	S
MFPT	53% n=8/15	16	0,02	S
TVPS	52% n=13/25	16	0,007	S
Jordan's L - R	68,8% n=11/27	16	0,004	S
DS	85,7% n= 6/7	16	0,03	S
DR	42,9% n= 3/7	16	0,55	N.S
PF	71,4% n= 5/7	16	0,1	B.S

Key:

(S) - Significant

(B) - Borderline

(NS) - Not Significant

n - Number of subjects

a - Number of subjects who performed below average on the particular test

b - Total number of subjects assessed on the particular test

Table VI indicates a significantly higher percentage of below average performance in the sample population, as compared to the normal population.Only the VMI test showed no significance.

It must be noted that the total number of subjects assessed on the DTLA - 3 was seven, hence this result should be interpreted with caution.

There appears to be significant below average performance on most of the tests, the Alternate Hypothesis is accepted.

Hypothesis (2) : A significant number of OBPP children present with above average visual perceptual skills and not below average visual perceptual skills.

Alternate Hypothesis (2) : A significant number of OBPP children present with below average visual perceptual skills and not above average visual perceptual skills.

This hypothesis was assessed by considering the below average performance , and the above average performance of the sample, against the normal population.
The results pertaining to Hypothesis 2 shall be represented in the following Figure VI and Table VII. Figure VI shows a comparison between Below Average and Above Average Performance on the tests.

FIGURE VI

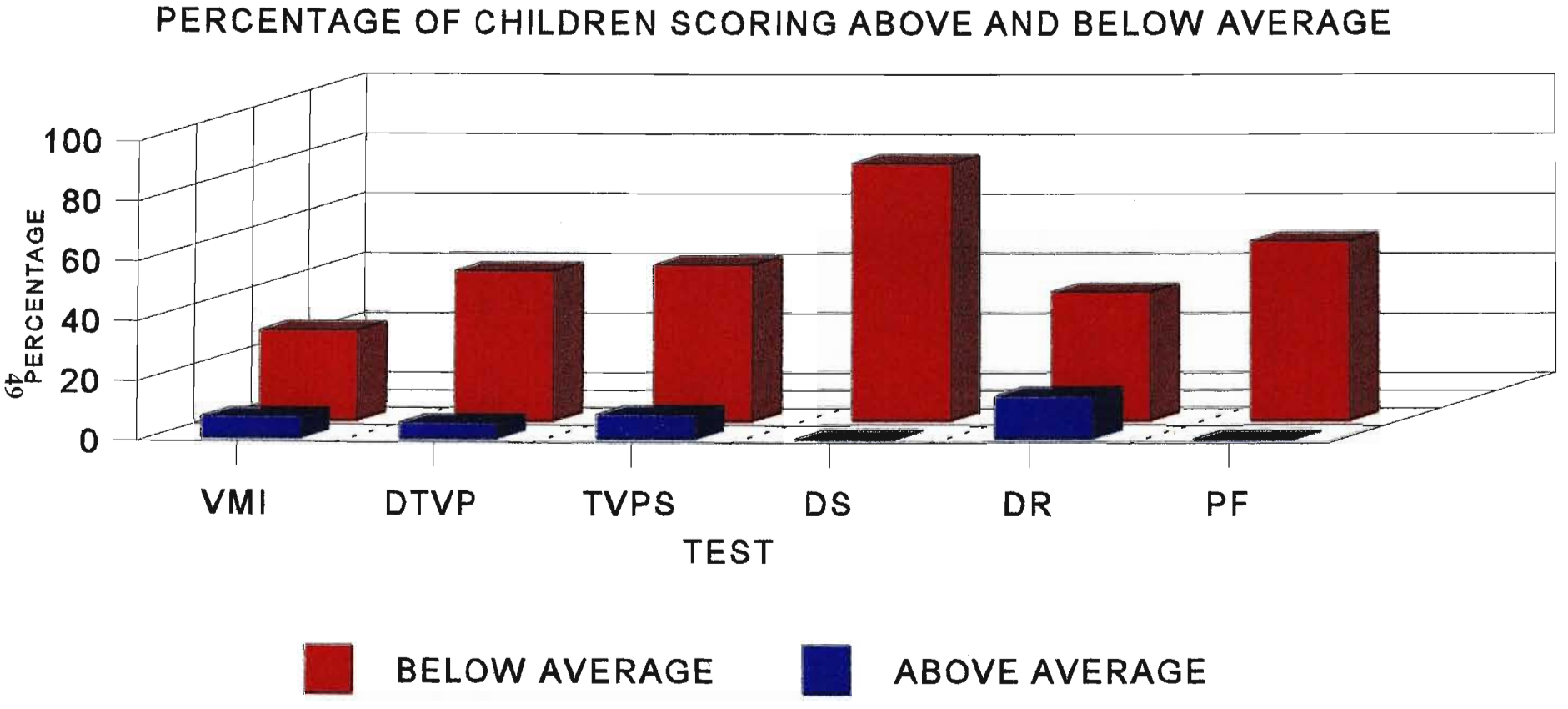

PERCENTAGE OF CHILDREN SCORING ABOVE AND BELOW AVERAGE
100
80
60
40
20
0
PERCENTAGE
VMI
DTVP
TVPS
DS
DR
PF
TEST
BELOW AVERAGE
ABOVE AVERAGE

TABLE VII

Association of Test performance (Above and Below average) against Normal population

ABOVE AVERAGE				BELOW AVERAGE		
n= a/b	*CHI SQUARE (P) (Fishers)*	*SIGNIFICANT(S) BORDERLINE(B) NOT SIGNIFICANT (NS)*	*TEST*	*n = c/b*	*CHI SQUARE (P) (Fishers)*	*SIGNIFICANT(S) BORDERLINE(B) NOT SIGNIFICANT (NS)*
2/30	0,43	NS	**VMI**	9/30	0,22	NS
1/25	0,66	NS	**TVPS**	13/25	0,007	S
1/7	0,44	NS	**DS**	6/7	0,03	S
1/7	0,44	NS	**DR**	3/7	0,55	NS
0/7	NIL	NS	**PF**	5/7	0,1	B
1/20	0.6	NS	**DTVP - GVP**	10/20	0,02	S

KEY:

n - Number of Subjects

a - Number of Subjects who had scored above average per test.

b - Number of Subjects per test

c - Number of Subjects who had scored below average per test.

Figure VI indicates that a smaller number of children with OBPP, have performed above average, than below average. Table VII indicates levels of significance on above average and below average performance on four visual perceptual tests. The tests which were excluded did not have scoring criteria for above average performance. As noted for Table VI, the interpretation of the performance on the DTLA-3 should be made with caution.

With reference to Table VI, the acceptance of the Alternate Hypothesis 1, the results indicated

by Table VII, the Alternate Hypothesis 2 is accepted.

Table VII, indicates no significant association between above average performance and OBPP children, on any of the tests, as compared to the normal population. Hence, the alternate hypothesis is accepted, indicating that a significant number of OBPP children present with below average visual perceptual skills.

Null Hypothesis (3) : No correlation exists between the level of lesion of the OBPP injuries and the severity of visual /motor perceptual abilities.

Alternate Hypothesis(3) : A positive correlation exists between the level of lesion of the OBPP injuries and the severity of visual/motor perceptual abilities.

The results indicating below average performance against the level of lesion is tabulated on the following page.

TABLE VIII

Below average performance on tests against the severity of the lesion.

TEST	U.T %	*NO: 13 n= a/b*	U+ M.T %	*NO: 8 n= a/b*	M. L %	*NO: 9 n= a/b*	L.T %	*NO: 0 n= a/b*	T %	*NO: 0 n= a/b*
VMI Test	30,8	*4/13*	25	*2/8*	33,3	*3/9*	0	*0*	0	*0*
DTVP	55,6	*5/9*	33,3	*1/4*	16,7	*1/6*	0	*0*	0	*0*
MFPT	50	*3/6*	25	*1/3*	50	*2/4*	0	*0*	0	*0*
TVPS	40	4/10	57	*4/7*	37,5	*3/8*	0	*0*	0	*0*
JORDANS	77,8	*7/9*	33,3	*2/6*	66,7	*4/6*	0	*0*	0	*0*
DS	100	*2/2*	100	*3/3*	0	*0*	0	*0*	0	*0*
DR	50	*1/2*	33,3	*1/3*	50	*2/2*	0	*0*	0	*0*
PF	100	*2/2*	66,7	*2/3*	50	*1/2*	0	*0*	0	*0*
CLIN.OBS	100	*12/12*	87,5	*7/8*	86,9	*20/23*	0	*0*	0	*0*

KEY :

JORDANS - Jordan's Left-Right Reversal Test

U.T - Upper trunk lesion

U. +M.T - Upper and Middle trunk lesion

M.L - Mixed lesion

L.T - Lower trunk lesion

T - Total lesion

NO: - Total number of subjects as per lesion

CLIN.OBS - Clinical and General Observations

n - Number of subjects

a - Number of subjects within a specific lesion and who had performedbelow average as per specific test.

b -Total number of subjects as per lesion, and assessed on a particular test.

Table VIII indicates percentage of OBPP children performing below average on the different tests, in accordance with their level of lesion of the brachial plexus.

With reference to Table VIII, it is evident that the total number of OBPP children falling in the five different Level of Lesion categories, are disproportionate. There are no children who presented with total or lower trunk lesions. In addition the number of children presenting with upper and middle trunk lesions are too small to make statistical comparisons.

There is insufficient evidence to draw a conclusion.Thus the Null Hypotheseis is not rejected, indicating that there is no evidence of a correlation between the level of lesion of the OBPP injuries and the severities of the visual perceptual ability.

4.2 ADDITIONAL INFORMATION

The study yielded additional important information, a part of which shall be described in this section. The reader is kindly requested to refer to the Annexure V for the supplementary results not listed in this section.

VALIDITY OF THE TESTS

In order to calculate test validity, the non motor tests were compared with each other. The same method was applied to the motor tests.The results are tabulated on the following page:

TABLE IX

Corelation between motor tests, and non motor tests.

TEST 1	TEST 2	PEARSONS COR. (r)	INTERPRET-ATION
VMI Test	VMI(DTVP)	0,38	Low Correlation
MFPT	TVPS	0,41	Moderate Correlation
MFPT	MRVP(DTVP)	0,40	Low Correlation
TVPS	MRVP (DTVP)	0,64	Moderate Correlation

Table indicating the magnitude of the relationship between the motor tests, and between the non motor tests.

KEY:

Motor Tests

VMI Test

VMI (DTVP)- VMI Composite Score of the DTVP.

Non Motor Tests

MFPT

MRVP (DTVP) - Motor Reduced Visual Perception Composite Score of the DTVP.

TVPS

The results suggest low correlation between the Motor Tests and low to moderate correlation between the Non Motor Tests. According to Guilford (1946), these scores indicate definite and substantial correlation, however not marked nor dependable.

ASSOCIATION OF PERFORMANCE ON MOTOR AND NON MOTOR TESTS

TABLE X

Correlation between motor and non motor tests.

PERFORMANCE			
MOTOR TEST	**NON MOTOR TEST**	**CHI SQUARE (p)**	**S/ B / NS**
VMI Test	MFPT	1,5	NS
VMI (DTVP)	MFPT	2,25	NS
VMI Test	MRVP (DTVP)	0,05	S
VMI (DTVP)	MRVP (DTVP)	0,05	S
VMI Test	TVPS	0,05	S
VMI (DTVP)	TVPS	0,07	B

Table indicating association of Average and Above Average performance on Motor tests; to Below Average performance on Non Motor tests.

Key:

S - Significant correlation

B - Borderline correlation

NS - No significant correlation

VMI (DTVP) - Visual motor integration Composite score of the DTVP

Paired Chi Square (Mc Nemar Chi Square) was used to calculate level of significance.

The number of discordinant pairs in the performance on motor and non motor tests indicate that, children with OBPP who perform average or above average on motor tests perform below average on non motor tests. This indicates overall better performance on motor skills.

4.3. LIMITATIONS

While the results appear to divulge some interesting findings, it is necessary to take into cognisance the limitations of the study.

The sample of thirty OBPP children was small. Adequate representation could not be obtained from the sample for some of the tests like the DTLA-3, as few children fell into the age classification used by the test in the study. Furthermore, about eight children with OBPP were partially assessed for the study and lost to follow up.

Twenty seven percent of the children had received Occupational Therapy for perceptual deficits, prior to commencement of this study.This may have confounded the results of the study as some improvements in their visual perceptual abilities, as a result of therapeutic intervention may have occured. It must be noted that these children were included in the study primarily as, they still presented with significant visual perceptual deficits.

The distribution of children amongst the different levels of lesions, were not adequate to perform statistical comparisons.There were no children with total lesions, or lower trunk lesions. Thirteen children presented with upper trunk lesions, eight with upper and middle trunk lesions, and nine with mixed lesions (refer to Table V).The number of children falling in the different level of lesions should have, ideally, been controlled.

Although the tests were representative of a wide, unbiased sample, the tests were not standardized for South African norms. This may have greater implications for the DTLA-3, the subtest on picture fragments in particular , as the pictures may have have not been culturally appropriate to our population. The Jordan's L - R , with it's three levels were administered to all but three Black children. Levels two and three were not administered to these children due to the language barrier. The other Black children attended English medium schools and hence understood and completed all Levels. It must, however be borne in mind that English was the second language for 43,3% of the sample.

Furthermore, two of the test batteries have since been revised; that being the VMI Test and the MFPT.

The use of an interpreter, may have influenced the standardizational ability of the test.

In terms of the learning developmental process, the greatest changes appear between four and eight years of age. Since such a wide age span was used in the study, and together with the small sample size, it was likely that this core age groups abilities were less evident.

The children came from various socio economic status backgrounds, which may have influenced their upbringing either positively or negatively, thus affecting performance.

Hereditary; handedness, familial history of learning problems, were not held constant.

It was not established as to whether any of the children had suffered a cerebral insult in utero or at birth. Only two children's Apgar scores were available, which was insufficient to make statistical comparisons.

The Candidate assessed all the OBPP children, which may have introduced some bias to the study.

There was low correlation between the Motor tests, VMI Test and theVMI - composite score of the DTVP, hence casting some doubt on the test validity.

Through statistical analysis, individual variation is lost.

Hence, although the study presents with interesting results, it is essential that the shortcomings of the study be considered when interpreting the data.

CHAPTER 5

DISCUSSION

5.1. DISCUSSION OF RESULTS

The spinal nerves; C5, C6, C7, C8, and T1, as well as it's contribution to the formation of the Brachial Plexus may be injured during delivery.

This is overtly manifested as paralysis of the upper extremity/s. Individuals experiencing such muscular weakness are commonly referred to as presenting with a physical disorder and hence treated as such.

The Model of Human Occupation, looks at physical dysfunction within a much broader perspective. Keilhofner (1985) defines physical disabilities as 'disturbance to the neurological and /or musculo skeletal constituents of skills'. Hence the individual is viewed in totality, incorporating any disruption of functioning in all areas of his or her life. The study did not include all areas of dysfunction that the OBPP child may have. It focused specifically on visual perceptual skills of the performance subsystem, which has previously not been addressed before.

Hypothesis I appeared to support the notion that, OBPP children, apart from the physical disability and having presented with poor motor capacity in the performance subsystem, also presented with deficits in the visual perceptual function.

With reference to Figure 2, between 30% and 86,2% of all the OBPP children presented with below average performance on the screening and assessment batteries. There is a significant relationship between the percentage of OBPP children who performed below average on each of the following non motor tests; MFPT, DTVP, TVPS, Jordan's L-R, DTLA-3 and Clinical and General Observations.

As 86,2% of the subjects presented with slight to severe deficiencies on the subtests of Clinical

and General Observations, this may indicate that many children presented with dysfunction in the cerebellar-vestibular system or [11]'soft neurological signs'. Due to the integrative functions of the senses, this would have likely affected the visual perceptual performance.

Thus, there appears to be an overall tendency to indicate that, the incidences of below average performance on these tests are greater for children with OBPP than for the normal population. This, however needs to be supported by further studies.

It must be noted that this significant relationship has not been shared by the VMI (Beery) Test. The overall validity results appear to indicate that the motor tests should be read with caution, due to the poor correlation between the VMI Test and the VMI composite component of the DTVP. The non motor tests, being MRVP component of the DTVP, MFPT and TVPS shared a 'definite' to'substantial' correlation relationship, with reference to Guilford's (1948) interpretation's guidelines. Refer to Table IX.

Although it might not be appropriate to compare the performance of the motor and non-motor tests owing to the poor correlation between the motor tests, the statistical analysis did indicate a significant relationship between the motor and non-motor tests. It was noted that children who performed average or above on the motor tests, scored below average on the non motor tests (Refer to Table X). This appears to cast a doubt on the theories of visual perception which stress the autonomy of the systems. It was also noted that the results were not in keeping with the trend supported by Newcomer and Hammil (1973), by suggesting that since OBPP is a motor disorder, there is likely to be poorer performance on the motor tests than non-motor tests. The opposite was true for this study. However when considering performance on the clinical observations, which involves kinesthetic and other general functions, this area presented with severe deficits. It is difficult to clearly demarcate the overall motor and non motor areas of functioning, hence the need for further research exists.

With respect to the **second hypothesis**, the presentation of poor visual perceptual abilities in children with OBPP has already been discussed (as for hypothesis 1).

---

[11]Soft Neurological Signs

Although there has been evidence of above average performance on some tests, the scores were not statistically significant. One OBPP child who had above average performance on the VMI Test, DTVP and TVPS came from the upper class of the socio economic class and was cared for by his mother during the day. The mother had the opportunity to stimulate the child to a greater extent than children cared by significant others ectetera. Both parents also had significant higher levels of education, with the father being a medical professional person. Hence these factors may have affected the way in which the child was raised, thus affecting his performance positively.

Importantly, however, of the four children who performed above average; only two showed consistency of performance throughout the tests. One child showed fluctuations in attention and concentration in the subtests. The other child showed impairment on motor tests.

Hence we may conclude that although certain OBPP children scored above average on some tests, the sample size was too small and hence these were shown to be not statistically significant.

Weiner (1993) reported that the degree of severity of the nerve lesion would dictate the rapidity and extent to which the lesion would recover.

With reference to **hypothesis three**, no statistical tests could be computed between the severityof the lesions due to the in congruency of the number of children presenting with specific lesions. It must be noted, however that although there were a specific number of children within three of the lesions, the test age classification further divided the low number of children in each lesion. Thus, there was no evidence of a correlation which exists between the level of lesion of the OBPP and the severity of the visual perceptual abilities. Given access to a larger population, the Candidate would have controlled the number of children within each lesion, in the study.

5.2. ADDITIONAL INFORMATION

Only 8% of the OBPP children displayed pure laterality (for eye, ear, foot and hand). This may support Domen Delacate's (William, 1984) theory of the resultant poor performance on the tests by many of the OBPP children. It must however be borne in mind that this theory has been

rejected by many theorists.

It must be noted that although almost all OBPP children received Occupational Therapy, 26,7% had received therapy for their visual perceptual disabilities prior to the commencement of this study. In total 90% of the subjects indicated a need for therapy- either visual perceptual therapy or detailed sensory integrative assessment and possibly treatment as well. Some children, however did not indicate poor school performance, as they had developed splinter skills to assist them cope, for example one OBPP child who was fifteen years ten months of age at the time of the assessment, was described as a 'very good student' by her parents. Subsequently on the VMI Test, a severe motor planning problem was noted. Thus the overall results appear to suggest that children with OBPP present with a higher incidence of poor visual perceptual deficits than the normal population.

Significant below average scores were also found in visual closure, position in space, visual form constancy, visual sequential memory and design sequences. Wall, in Fisher et al. (1991), reported that the motor response has the effect of collecting more afferent information about the circumstances surrounding a stimulus detected by the somatosensory system. As the OBPP child displayed significant performance on the position in space (indicating poor perception in space of an object in relation to each other, one may assume that it may have been likely that the motor disability from birth inhibited the OBPP child to a certain extent to explore the environment in relation to himself. The children did appear to perform adequately on detecting objects in relation to each other (spatial relations).

As 44,4% of the parents indicated that their children did not cry immediately after birth (Refer to Table XIX), the scores on the MFPT and the TVPS indicate a significant correlation between poor performance on these tests and with the OBPP children who did not cry immediately after birth (Table XX). The fact that the children did not cry after birth may indicate that these children presented with asphyxia at birth. This appears to support Shah's (1991), premise that birth asyphxia and birth trauma are the leading causes of mental disability in developing countries (refer to Chapter II).

Also 57% of the OBPP children had their left arm affected. Ninety-four percent of this sample became right-handed. Thus there appears to be a trend which supports the notion that the OBPP child would choose the unaffected stronger arm to become the dominant hand. It must be borne in mind that 95% of the parents were right-handed, hence the likelihood of these children becoming right-handed was very high (Table XII). Comparative studies against performance of right-hand dominance and left-hand dominance of children from right-handed parents, appears to indicate that the general trend was for the right-handed child to perform better than the left-handed child. A greater percentage of left-hand dominant children performed poorer on the tests than the right-hand dominant children (Table XIII). Such performance supported the views held by Springs and Deutsch (1981), as discussed in Chapter 2. If one accepts the theory of hereditary in order to establish dominance, this opens the door for further questions, like does pathological handedness of the right-hand cause perceptual dysfunction in children having both parents right-handed vice versa. The study appears to address this issue, indicating that children with pathological handedness of the right-hand and thus becoming left-hand dominant, and having both right-handed parents, perform poorer on tests than right-handed children, having right-handed parents. Further studies are needed to confirm this.

It must be noted that one subject presented with bilateral OBPP, and performed below average on both motor and non motor tests.

Table XI indicates a significant score for below average performance amongst the population for both the motor subtests of the DTVP.This would support the premise that due to the pathological handedness, the child had to use the 'non-dominant hand'. As mentioned in the previous paragraph the association between performance in subjects with pathological handedness and perceptual function needs to be further addressed. This association must be read with caution due to the low correlation between the motor tests.

While the data appears to provide some interesting preliminary evidence on the visual perceptual abilities of OBPP children, further investigation is still required.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

Continued observations that were made at the Brachial Plexus Clinic at King Edward VIIIth Hospital, initiated a preliminary investigation of the visual perceptual abilities of OBPP children. No such study was undertaken previously and, although the study suggests validation by further research, the results of the study draws one's attention to the likelihood of visual perceptual deficits in such children. The results appear to indicate that there is a greater incidence of below average performance in OBPP children than in the normal population. Although a small number of children excelled in some tests, this number was not significant.

No correlation could be identified between the severity of lesion and the visual perceptual ability, as the sample was not representative of all lesions.

Hence it appears that one of the most crucial inferences from the study is, the importance to Occupational Therapists (and other team members) in incorporating visual perceptual assessment and treatment in the management of OBPP children, who demonstrate such deficits. This would also lend it to more dynamic team work; by fascilitating more accurate referrals.

7.1. RECOMMENDATIONS FOR FUTURE RESEARCH

To date, this area of study (Visual Perceptual abilities in OBPP children) had been largely an unexplored area.

The study encourages further enquiry into some of the following aspects:

The result of this study interestingly indicates the likelihood that OBPP children do indeed present with visual perceptual deficits. It must be emphasized however, that this research study requires further reliability and validity studies. To facilitate this process, it is hoped that more accurate, reliable and representative assessment tools become available in South Africa. It is recommended that the sample be more representative, taking into cognisance the different ethnic groups; socio economic status; smaller age ranges; the different level of lesions of brachial plexus injuries, etcetera.

When forwarding letters to Institutions, it is recommended that the Orthopaedic Clinics and Paediatric Clinics be targeted encouraging referral of such patients. Contact with these Departments should be maintained at least six monthly.

Further in-depth sensory integrative assessments should be performed, which may facilitate better understanding of the sensory integrative processes of such children. This may include investigating whether monopareisis affects the bilateral motor integration /or any other processes of sensory integration in such children. Other studies may address the likelihood of body image disturbances and it's impact on the OBPP child's life.

OBPP presents as an ideal and interesting case in further investigations of the theories of visual perception, in particular the autonomy of the motor and non motor systems. It also encourages the influence of motor disability (monoparesis) on the developmental milestones of the child. The latter would involve investigation of the OBPP child from infancy. Further investigations may focus on the influence of dominance and laterality on perceptual performance.

As noted in Chapter 2, there are various theories on dominance. Whilst there are theories which address pathological handedness as result of brain lesions (Soper and Satz-1984), there appears to be limited research available on the presentation of pathological handedness as a result of brachial plexus injuries. An investigation as to whether Left-hand dominant OBPP children with Right-handed parents present with brain lesions, may prove to be an interesting study.

Other studies on dominance may address hemispheric dominance. This may involve reading assessments, speech assessments, etcetera.

Haptic perception (like stereognosis), in relation to visual perceptual abilities may also be addressed. Children with OBPP have impaired tactile sensation, and as Henderson and Pehoski (1995) proposed that a break in the sensory feedback mechanism, would alter the child's ability to explore objects with the hands which may/may not influence the child's learning (Refer to Chapter 2).

The study presents an awakening of the likelihood of OBPP children, having in addition to their physical disability, visual perceptual disabilities. This encourages a more holistic treatment of the child, thus encouraging the Occupational Therapist to now assess the area of visual perception, which, in the past, had been overlooked. Furthermore, the implication of this study is likely to encourage greater improvements in obstetric and perinatal care.

The causes of the likelihood of poor visual perceptual ability should be explored. More thorough investigations into the birth history, the Apgar scores, presence of asphyxia at birth, amongst others should be investigated. This information would be most useful in the understanding of the presentation of the visual perceptual abilities, by both the medical professions as well as the parents.

Joint studies with other medical disciplines, for example the psychologist, should be pursued particularly in areas such as attention and concentration; the psychological impact of OBPP on the growth of the child etcetera.

It is hoped that this study provides a new focus for future research in this area.

GLOSSARY

[1]*Neuropraxia*

Injury to the myelin sheath of the nerve but the axon is not disrupted. Complete restoration of function can be anticipated (Malick and Kasch, 1984).

[2]*Neurotmesis*

The nerve is completely transected. The possibility of complete functional return without surgery is remote (Malick and Kasch, 1984).

[3]*Horner's Sign*

Often present on the affected side of the limb affected by brachial plexus palsy, because of the involvement of the sympathetic fibres that traverse the T1 primary nerve ramus on the ipsilateral side (Hunter et al. 1990). Symptoms include ptosis, and absence of sweating on the affected side of the face (Livingston, 1989).

[4]*Cognition*

A conscious thought process that refers to the awareness and knowledge of objects, perceptions, thoughts and memories. In addition to knowledge, it includes the abilities to understand, reason, make decisions, and apply judgement (Zoltan in Arnadottir, 1990).

[5]*Visual Motor Integration*

Visual motor integration is the coordination of visual information with movement. The term is often used to indicate the ability to copy geometric forms (Henderson and Pehoski, 1995).

[6]*Homonculus*

The areas for body sensations and voluntary control of movements are divided into sections that deal with a particular part of the body. There are sections for every part of the body, which are represented in the precentral and postcentral gyri of the hemispheres (Ayres, 1981 & Arnadottir,

1990).

[7]*Occupational Behaviour*

This is an activity in which the persons engage during most of their waking time, it includes activities that are playful, restful, serious and productive (Kramer, 1993).

[8]*Volitional Subsystem*

This is based on motivation towards exploration and mastery of the environment. Motivation is energizing and determines conscious choices of behaviour (Kramer, 1993).

[9]*Habituation Subsystem*

This system views behaviour in terms of habits, patterns of actions and roles (Keilhofner, 1985).

[10]*Performance Subsystem*

It is concerned with skills that provide the foundation for action (Keilhofner, 1985).

[11]*Soft Neurological Signs*

These are fine, subtle and minor symptoms that include - mild coordination difficulties, minimal tremors, motor awkwardness, visual motor disturbances, deficiencies, or abnormal delays in language development, and difficulties in reading and arithmetic skills (Lerner, 1985, pages 203-204).

REFERENCES

Al-Qattan, M.M., Clarke, H.M. and Curtis, C.G. (1995). Klumpe's birth palsy. Does it really exists? *The Journal of Hand Surgery,* 20 (1); 19-23.

Annett, M., Ockwell. (1980). Birth order, birth stress and handedness. *Cortex,* 16; 181 - 188.

Arnadottir, G. (1990). *The brain and behaviour. Assessing cortical dysfunction through activities of daily living.* United States of America: CV Mosby Company.

Aslin, R.N. and Smith, L.B. (1988). Perceptual Development. *Annual Review of Psychology,* 39, 435 - 473.

Ayres, A.J. (1972). *Sensory integration and learning disorders.*United States of America: Western Psychological Services.

Ayres, A.J. (1980). *Sensory integration and learning disorders.*United States of America: Western Psychological Services.

Ayres, A.J. (1981). *Sensory integration and the child.* Fourth edition. United States of America: Western Psychological Services.

Beery, K.E. (1989). *The Developmental Test of Visual Motor Integration. Administration, scoring and teaching manual.* Third edition. Cleveland: Modum Curriculum Press.

Belka, D.E., Williams, H.G. (1979). Prediction of later cognitive behaviour from early school perceptual -motor, perceptual and cognitve performances. *Perceptual and Motor Skills,* 49; 131 - 141.

Bora, F.W. (1986). *The paediatric upper extremity. Diagnosis and management.* United States of America: W. B. Saunders Company.

Bowman, O.J. and Wallace, B.A. (1990). The effects of socio economic status on hand size and strength, vestibular function, visuo motor integration and praxis in Preschool children. *The American Journal of Occupational Therapy,* 44(7); 610 - 621.

Boyer, G. F. (1911). The complete histo - pathological examination of the nervous system of an unusual case of Obstetric paralysis, forty one years after birth. - A review of the pathology. *Proceedings of the Royal Society of Medicine,* 5; 31 - 58.

Brand, H.J., le Roux, M.C. (1991). A factor analytic study of the Revised Test of Visual Motor Integration. *The South African Journal of Occupational Therapy,* 21(2); 12 - 15.

Concha, M.E. (1989). Reliability and validity studies on the Developmental Test of Visual Motor Integration. *The South African Journal of Occupational Therapy,* 19(17); 17 - 25.

Covey, D.C., Riordan, D.C., Milstead, M.E. and Albright, J.A. (1992). Modification of the L'Episcopo procedure for brachial plexus birth palsies. *The Journal of Bone and Joint Surgery,* 74-B(6), 897-901.

Cratty, B.J. (1970). *Perceptual and motor development in infants and children.* London: The Macmillan Company.

Crowe, T.K., McFall, S.A. and Deitz, J.C. (1993). Test retest reliability of Test of Visual Perceptual Skills with children with Learning Disabilities. *The American Journal of Occupational Therapy,* 47(9); 819 - 824.

Day, R.A.(1989). *How to write and publish a scientific paper.* Third edition. United States of America: The Oryx Press.

Dodd, K. and Hull, J. (1991). What is birth asyphyxia? *British Journal of Obstetrics and Gynaecology,* 98; 953 - 955.

Dommisse, G.F. and Lindeque, B.P. G. (1988). *Clinical imperatives in surgery and orthopaedics.* Pretoria: HAUM Educational Publishers.

Duthie, R.B. and Ferguson, A.B. (1973). *Mercers orthopaedic surgery.* Seventh edition. Great Britain: Butler and Tanner Ltd.

Fisher, A. G., Murray, E.A. and Bundy, A.C. (1991). *Sensory integration. Theory and practice.* United States of America: F. A. Davis Company.

Frostick, S.P. (1995). The future in brachial plexus injuries and their treatment. *Microsurgery,* 16; 45 - 48.

Gardner, M.F. (1982). *TVPS. Test of Visual Perceptual Skills (non motor). Manual.* United States of America: Psychological and Educational Publications, Inc.

Gardner, M.F. (1992). *TVPS-UL. Test of Visual Perceptual Skills (non motor). Upper level. Manual.* United States of America: Psychological and Educational Publications, Inc.

Gilbert , A., Brockman, R. and Carlioz, H. (1991). Surgical treatment of brachial plexus birth palsy. *Clinical Orthopaedics and Related Research,* 264; 39-47.

Guilford, J.P. (1946). New standards for test evaluation. *Educational Psychological Measurement,* 10; 427 - 428.

Griesal, R.D., De Wet, A., Falkson, A. and Richter, L. (1989). Die Effek van 'n lerapeutiese opleidings program op die motoris peceptuele vermoes van swart graad kinders. *The South African Journal of Occupational Therapy,* 19(1); 38 - 49.

Hammill, D.D., Pearson, N.A. and Voress, J.K. (1993). *Developmental Test of Visual Perception.* Second Edition. United States of America: Pro - Ed, Inc.

Harber, J.R. (1979). Perception and perceptual - motor integration. There is a a difference. *Perceptual and Motor Skills,* 49; 917 - 918.

Helm, M. E. and Concha, M.E. (1995). The use of Developmental Test of Visual Motor Integration (Beery - 1982) with the South African Urban Black Child. *South African Journal of Occupational Therapy,* 20(2); 10 - 17.

Henderson, A. and Pehoski, C. (1995). *Hand function in the child. Foundations for remediation.* United States of America: CV Mosby Company.

Hudgins, A.L. (1977). Assessment of visual motor abilities in young children. Towards differential diagnosis. *Psychology in the Schools,* 14(3); 252 - 260.

Hunter, J.M., Schneider, L.H., Mackin, E.J., and Callahan, A.D. (1990). *Rehabilitation of the hand.Surgery and therapy.* Third edition.
United States of America: The CV Mosby Company.

Jahnke, A.H., Bovill, D.F., Mc Carroll, H.R., James, P. and Ashley, R.K. (1991). Persistent brachial plexus birth palsies. *Journal of Paediatric Orthopaedics,* 11(4); 533-537.

Jordan, B.T. and Jordan, S.G. (1990). Jordan Left - Right Reversal Test: An analysis of visual reversals in children and significance for reading problems. *Child psychiatry and Human Development,* 21(1); 65 - 73.

Jordan, B. T. (1974). *Jordan Left - Right Reversal Test Manual.* California: Academic Therapy Publications.

Keilhofner, G. (1985). *A model of human occupation: Theory and application.*

Baltimore: Williams and Wilkins.

Kephart, N.C. (1971). *The slow learner in the classroom*. Second Edition. Columbus: C.E.M. Publishing Company.

Kopp, C.B. and Shapermen, J. (1973). Cognitive development in the absence of object manipulation during infancy. *Development Psychology,* 9(3); 430.

Kramer, P. and Hinojosa, J. (1993). *Frames of reference for paediatric Occupational Therapy.* United States of America: Williams and Wilkins.

Krefting, L.H. (1985). The use of Conceptual Models in Clinical Practice. *Canadian Journal of Occuaptional Therapy,* 52(4); 173 - 178.

Lamb, D. (1987). *The paralysed hand.* Edinburgh : Churhill Livingstone.

Lerner, J. (1985). *Learning Disabilities. Theories, diagnosis, and teaching strategies.*Fourth edition.Boston: Houghton Mifflin Company.

Leonard, P.A. (1986). *Visual perception: The relationship between Motor Free and Visual motor measures*. Masters thesis - University of Port Elizabeth.

Linge, I. and Cameron, N. (1986). An investigation of the Motor Free Perception Test. The reliability on South African White Children aged five to seven years. *South African Journal of Occupational Therapy,* 16(1); 21 - 25.

Livingstone, R.B. (1978). *Sensory processing, perception and behaviour.*New York: Raven Press.

Livingstone, C. (1989). *Illustrated Churchills Medical Dictionery.*
United States of America : Churchill Livingstone Inc.

Lyman, H.B. (1986). *Test scores and what they mean.* Fourth edition. New Jersey: Prentice - Hall Englewood Cliffs.

Malick, M.H. and Kasch, M.C.(1984). *Manual on the management of specific hand problems.* United States of America: Aren Publishers.

Mchale, K. and Cermak, S.A. (1992). Fine motor activities in elementary school. *Preliminary findings and provisional implications for children with fine motor problems,* 96(10); 898-903.

Michelow, B. J., Clark, H.M., Curtis, C.G., Zuker R.M., Seifu, Y. and Andrews,D.F. (1994). The natural history of obstetric brachial plexus palsy. *Plastic and Reconstructive Surgery,* 93(4); 675-680.

Molfese, D.L. and Segalowitz, S.R. (1988). *Brain lateralization in children. Developmental implications.* United States of America: The Guilford Press.

Newcomer, P. and Hammill, P. (1973). Visual perception of motor impaired children. Implications for assessment. *Exceptional Children,* 40; 335 - 338.

O'Callaghan, M. J., Burn, Y.R., Mohay, H.A., Rogers Y. and Tudehope, D.I. (1993). The prevalence and origins of left hand preference in high risk infants, and it's implications for intellectual, motor and behavioural performance at four to six years. *British Journal of Psychology,* 61(4); 545 - 558.

Palmer, J.O. (1970). *The psychological assessment of children.* United States of America: John Wiley and Sons Inc.

Polit, D. F. and Hungler, B. P. (1991). *Nursing research principles and methods.* Fourth edition. United States of America: J.B. Lippincott Company.

Prechtl, H. F.R., Cioni, G., Ferrari, F., Einspieler, C., Paolicelli, P.B. and Barbani, M.T. (1997).

Comparison between observations of spontaneous movements and neurological examination in preterm infants. *Journal of Paediatrics,* 30(5); 704 - 711.

Ramlaul, A. (1996). Functional implications of lateral rotation osteotomy in Obstetric Brachial Plexus Injuries. *The Finger Print,* (March - April); 9 - 11.

Riordan, Z.V.A. (1978). *Locus of control in South Africa. A Cross - Ethnic study.* Doc. Thesis. University of Port Elizabeth.

Roediger, H.L., Rushton, J.P., Capaldi, E.D. and Paris, S.G. (1984). *Psychology.* Boston: Little Brown and Company.

Roger, S. (1994). A survey of the assessments used by Paediatric Occupational Therapists. *Australian Occupational Therapy Journal,* 41(3); 137 - 142.

Romanes, G. J. (1986). *Cunninghams manual of practical anatomy. Volume one: Upper and lower limbs.* Fifteenth edition. Honk Kong: Oxford University Press.

Shah, P. M. (1991). Prevention of mental handicaps in children in Primary Health Care. Bulletin of the World Health Organization, 69(6); 779 - 789.

Sharrard, W.J.W. (1979). *Paediatric orthopaedics and fractures.* Second edition. London: Blackwell Scientific Publications.

Seddon, H. (1975). *Surgical disorders of peripheral nerves.* Second edition. United States of America: Longman Group Limited.

Soper, H.V. and Satz, P. (1984). Pathological left handedness and ambiguous handedness: a new explanatory model. *Neuropsychologia,* 22(4); 511 - 515.

South African Institute of Sensory Integration Research Committee. (1986). *Clinical*

Observations adapted from Ayres - Administration and Interpretation.

Springer, S. P. and Deutch, G. (1981). *Left brain right brain.* San Fransisco : W. H. Freeman and Company.

Stephen, J., Carlan, M.D., Jeffery, L., Angel, M.D., Robert. A. and Knuppel, M.D. (1991). Shoulder Dystocia. *American Family Physician,* 43(4); 1307-1311.

Stott, M. and Henderson, L. (1972). *Test of Motor Impairment.* Canada: Brook Educational Publishing Company Ltd.

Sunderland, S. Sir. (1991). *Nerve injuries and their repair. A critical appraisal.* Edinburgh: Churchill Livingstone.

Thomas, L.K. and Hacker, B. J. (1987). *A Therapists guide to Paediatric Assessement.* United States of America: Little Brown and Company.

Umansky, R. (1974). Effect of a hand sock on precision in infancy. *Developmental Psychobiology,* 7(5); 407 - 419.

Verdonck, M.C. and Hennenberg, M. (1997). Manual dexterity of South African Children growing in contrasting socio - economic conditions. *The American Journal of Occupational Therapy,* 46(9); 775 - 783.

Weiner, D.S. (1993). *Paediatric Orthopaedics.* United States of America: Churchill Livingstone.

Williams, H.G. (1983). *Perceptual and motor development* . United States of America: Prentice Hall Inc.

Wilson, B., Pollock,N., Kaplan, B.J., Law, M. and Faris, P. (1992). Reliability and construct validity of the Clinical Observations of motor and postural skills. *The American Journal of Occupational Therapy,* 46(9); 775 - 783.

Vorster, M.H. and Brand, H. J. (1995). The validity of the developmental test of visual motor integration in the South African concept. A pilot study. *South African Journal of Occupational Therapy,* 25(2); 28 - 33).

Zeitschel, A.L., Kalish, R.A. and Colarusso, R. (1979). Visual Perception tests used with physically handicapped. *Academic Therapy,* 14(5); 564 - 576.

Zuben, M.V., Cist, P.A. and Mayberry, W.C. (1990). A pilot study of differences in play behaviour between children of low and middle socio economic status. *The American Journal of Occupational Therapy,* 45(2); 113 - 118.

ANNEXURE I

LETTERS

Psychological and Educational Publications inc.

1477 Rollins Road Burlingame, California 94010 Teleph [illegible] 340-9669

June 23, 1996

Miss O. Nukanna
Senior Occupational Therapist
71 Impala Drive
Mobeni Heights
Durban
South Africa
4092

Dear Miss [illegible]anna:

Thank you for your letter of March 11, 1996, in which you asked to have some points clarified regarding the TVPS (N-M).

The answer to your first question is not known to this writer. I believe that the reason could be due to the fact that the MFPT is too limited in the number of items, the number of subtests, and the norms (The MFPT provides only a perceptual quotient whereas the TVPS has 16 items for each of the 7 subtests and norms for each of the 7 subtests).

The answer to your second question is: if a subject performs poorly on any one subtest or on a number of subtests, examiners should suspect that the subject's poor performance is indication of a learning problem(s) of one kind or another. This, then, is reason to administer other tests primarily to determine if a learning problem(s) exists and to determine the type of learning problem(s).

The answer to your third question is: since the TVPS is a cross-cultural test (possibly cultural-free), it can be administered to subjects of all races and to subjects in various geographic areas of the world. The TVPS is free of language (verbal or written) except for the directions which can be given in any language. The TVPS is a non-bias test. The TVPS was not standardized nor normed on isolated groups of subjects such as urban and rural.

The TVPS, along with the Test of Visual-Motor Skills-Revised, would be appropriate for Black South African subjects from rural areas.

While there has been a great deal of research done on the TVPS; I do not have in my possession the results of any of the research, however, I do have copies of the research done on the TVPS by occupational therapists published in the American Journal of Occupational Therapy. If you wish copies of these research articles, I will forward them by mail.

I would strongly suggest that you consider the TVPS and the TVMS-R for use with your population.

Sincerely,

Morrison F. Gardner

Morrison F. Gardner, Ed. D.
Psychologist

NATALSE PROVINSIALE
ADMINISTRASIE

TAK HOSPITAALDIENSTE

NATAL PROVINCIAL
ADMINISTRATION

HOSPITAL SERVICES BRANCH

☎ (031)3603292

FAX (031)256719

☒ Occ. Therapy Dept
King Edward VIII Hospital
Congella
Durban
4013

10 March 1996

The Head
Occupational Therapy Dept/Physiotherapy Dept

Madam/Sir

RE: Erbs Palsy Patients

I am a Senior Occupational Therapist at King Edward the VIIIth Hospital, and being a Training Hospital we have Specialist Clinics at the Hospital.The Brachial Plexus Clinic is held every 1st and 3rd Tuesday in a month. The Clinic has full compliment of the Team, and decisions are made regarding reconstructive surgery,exploration of the plexus etc.

I am presently studying for my Masters in Occupational Therapy, and am involved in assessing Erbs Palsy patients.This includes a detail perceptual and physical assessment.

I would be most grateful if you could refer all erbs palsy patients, irrespective of age, to me.A history (including any medical surgery which the patient may have underwent)would be most beneficial.These patient's, under your recommendations,
would also be presented at the Brachial Plexus Clinic.Strict correspondence between the refering hospital and King Edward the VIIIth Hospital would be maintained.
Rehabilitation will continue at the most accessable hospital to the patient.

Please complete the attached form and reply as soon as is possible.

Your coorporation is most highly appreciated.

Yours faithfully

_____(SENIOR OCCUPATIONAL THERAPIST)
O.NUKANNA (MISS)

NAME OF HOSPITAL/CENTRE/SCHOOL:

OCCUPATIONAL THERAPIST/PHYSIOTHERAPIST:

TELEPHONE NO: FAX NO:

NO. OF ERBS PALSY PATIENTS TREATED AT YOUR HOSPITAL/CENTRE:

NO: OF SUCH PATIENTS LIKELY TO BE REFERRED:

AGES OF THE PATIENTS(if possible):

COMMENTS :

Please cut off along this line, and return.

Please note:It is acceptable that a)Should you get such patients during the course of the next 2 years, to continue refering the patients.

b) If uncertain of the number of patients and their ages,please note-Uncertain or stipulate an approximate number if possible, and when the patient comes for their follow up appointment,please initiate contact through the telephone number stipulated on the letterhead.

KWAZULU NATALSE PROVINSIALE
ADMINISTRASIE

TAK GESONDHEIDDIENSTE

☎ : 360-3292

✐ : 256719

FAX :

ENQ.: MISS. O. NUKANNA

KWAZULU NATAL PROVINCIAL
ADMINISTRATION

HEALTH SERVICES BRANCH
KING EDWARD VIII HOSPITAL
PRIVATE BAG
CONGELLA
4013.

DATE: _____

_____

_____

_____

_____

Dear Sir / Madam,

RE: _____

The abovementioned is an Out-patient of King Edward VIII Hospital.

The above patient needs to be reviewed at the Brachial Plexus Clinic.

Furthermore, the learning abilities of all the Brachial Plexus patients are being assessed for a Research Study. Should you bring your child in for these assessments, the results would be discussed with you and would be of great benefit in terms of the patients schooling.

Your co-operation in this matter will be highly appreciated.

Yours faithfully,

O. NUKANNA
SENIOR OCCUPATIONAL THERAPIST.

KWAZULU NATALSE PROVINSIALE ADMINISTRASIE

TAK GESONDHEIDDIENSTE

KWAZULU NATAL PROVINCIAL ADMINISTRATION

HEALTH SERVICES BRANCH

☎ : 3603292

FAX : 256719

King Edward VIII Hospital
Private Bag
CONGELLA
4013

E-iQ:

REF:

DATE: _____

_____

_____

_____

_____

Dear Sir/Madam,

_____

Lona ochazwe ngenhla uyisiguli sangaphandle salapha e-King Edward VIII Hospital.

Lesisiguli esingenhla kudingeka sihlolwe e-Klinik i- Brachial Plexus. Imininingwane; yokufundisa zonke iziguli ezingo-Brachial Plexus iyokuhlolwa ngokuhlanganyela. Kumele ulethe ingane yakho ukuzohlolwa. Imiphumela iyochazelwa wena, futhi iyokuba usizo olukhulu mayelana nokulolongela isiguli ukufunda.

Ukubambisana nawe kuloludaba kuyokuba enkulu impumelelo.

Yours faithfully,

_____

O. NUKANNA
SENIOR OCCUPATIONAL THERAPIST.

ANNEXURE II

PARENTAL CONSENT

DEPARTMENT OF OCCUPATIONAL THERAPY
KING EDWARD VIII HOSPITAL
PRIVATE BAG
CONGELLA
4013

Dear Mzali/Mphathi Othandekayo

Uyacelwa ukuba unikeze ingane yakho imvume_____
yokuhlanganyela esifundweni sokuhlolwa ngu Nkosazana O.Nukanna.
Iimiphumela yokuhlolwa kuyoxoxiswana ngayo kanye nawe, noma iyiphi inkinga eyotholakala emntwaneni iyokwethulwa kuwe.

_____ _____
Mzali/ Kumphathi O.Nukanna (Nkz)
Senior Occupational Therapist

DEPARTMENT OF OCCUPATIONAL THERAPY
KING EDWARD VIII HOSPITAL
PRIVATE BAG
CONGELLA
4013

Dear Parent/Guardian

Please grant permission for your child_____, to participate in a Research Study, by Miss O.Nukanna.
The results of the assessment will be discussed with you, and any problems which present shall be attended to.

_____ _____
Parent's/Guardian's Signature O.Nukanna(Miss)
Senior Occupational Therapist

ANNEXURE III

METHODOLOGY, CONTINUED

Clinical Observations

The observations were recorded according to the following key:

3 - Normal

2 - Mild Deficiency

1 - Definitely Deficient

Equipment Needed:

Two small chairs

Chair/ stool high enough for the child's feet to be off the ground

Stopwatch

Paper cone

Card 10cm x 10cm with a 0.5cm hole in the centre

Pencil with rubber

Large therapy ball

Masking Tape

Soccer size ball

a) Slow Movements

The test required that the subject held his/ her shoulder's at 90 degrees abduction with the finger tips touching the shoulders. He slowly extended the elbow and then returned them to their original position without counting aloud. This observation was important for children with vestibular problems, bilateral integration and motor planning problems, hemispheric dysfunction and pyramidal and extra pyramidal problems.

b) Diadokokinesis

The child's ability to pronate and supinate the forearm on the thigh, whilst sitting was assessed. Each arm was done individually and then bilaterally. Inadequate performance on this test showed difficulties in bilateral integration, specifically muscle weakness, motor planning, associated reactions of the hand or mouth may indicate immaturity of the nervous system.

c) Thumb Finger Touching

The subject opposed each finger with the thumb in sequence from the index to little finger, and then touched the little finger again back to the index. Each hand engaged in the task individually and then bilaterally. Inadequate performance on this test would indicate difficulty in motor planning and poor proprioceptive awareness.

d) Eye Preference

Equipment needed; are a paper cone and a card 10cm x 10cm with a hole 0.5 cm in the centre. The Candidate first had asked the child to look at her through the paper cone and thereafter through the hole in the card. Specific observations with regards to the hands being used, the transferring of objects, indecision on the choice of the eyes, were recorded and scored.

e) Ear Preference

The Candidate asked the child to place the paper cone to the ear, and listen carefully in order to report the sounds that he or she had heard. The cone was given to the child, in the midline, in the seated position, as above, with both hands. The Candidate had observed which hands were used, which ear the cone had been taken to first as well as the indecisiveness of the behaviour was recorded; either a one, two or three.

f) Independent Eye Closure

In this subtest the child had to close each eye independently. The Candidate observed for associated movements, which eye was closed first and the ability to dissociate one eye from the other.

g) Eye Movements

This test assessed the ability of the child to establish and maintain visual contact with an object. The test involved the child watching the top of a pencil (eraser) with the eyes, without moving the head, as the Candidate moved the pencil in various arcs.

The Candidate observed the ability of the child to move his eyes rather than his head, whether the pursuit movements were smooth and well coordinate, and the association between the movements of the eyes.

h) Cocontraction

This tests the child's ability to cocontract simultaneously muscles around the upper limb and trunk and then around the neck and trunk.

It involved the child being seated on a high chair with the feet off the floor. The Candidate sat in front of the child, and the child had to flex the shoulder and elbow and squeeze the Candidate's thumb, whilst she pushed or pulled the child.

The Candidate had to note the ability of the child to hold the position, left right differences, inability to perform, strength of grasp and others. The child was then scored appropriately.

i) Protective Extension (Legs)

This tests the child's quality of protective response of the legs. The child stood with the feet together and the Candidate pushed the child forward, sidewards, then backwards whilst being ready to prevent the child from falling. The Candidate had to note the ability of the child to step in the direction of displacement, quality and speed of response.

j) Throwing and Catching

The test, tests the quality of the child's ability in throwing and catching a ball. The child had to throw the ball, to the Candidate, who had to observe the aim of the ball, hand/s used, associated movements, and mass extension patterns. This was then scored.

After the child threw the ball to the Candidate, she threw the ball back to the child to observe the child's catching skills. Both throwing and catching had three trials. The Candidate observed the child's skill and quality, associated movements, anterior posterior movements, and transfer of weight and rotation of the pelvis. This was then scored.

k) Hopping

The test of hopping tested the child's ability of and quality of hopping.

A one metre length of masking tape was laid on the floor. The Candidate had first demonstrated hopping on one foot along the masking tape line, and thereafter the child had to copy. The Candidate ensured that the child hopped on the other leg on the next trial. Observations were made with regard to which foot was used first, skill and quality in coordination and associated movements. This was then scored.

In addition to the above Ayres Clinical Observations, the following screening tests and observations were also made. The same scoring system, as for Clinical Observations(Ayres) were used.

l) Walking on a Line

This subtest (Stott, Moyes and Henderson, 1971), involved using the masking tape, as placed for hopping. The child had to walk along the line placing the heel of one foot against the toe of the other. The child had to complete ten steps, with the hands held on the hips and eyes open. The children were given three trials each.

The test was critically evaluated for children six years and over, whilst those below six had to demonstrate their ability that they could at least walk a straight line.

The child was failed on a trial, if :

I. (I) The child moved the foot from the line to maintain balance,

(II) The child did not place each foot on the line,

(III) The child removed the hands from the hips,

(IV) The child swayed and did not return to an upright position on the line,

(V) The child's heel toe did not touch at each step, with small adjustments being allowed to close the gap.

The child was given a score of one, as having had a definite problem if the child did not make two successful attempts from the three trials. A score of two was given if the child only made one successful attempts out of the three trials. Two or three successful attempts were scored as three.

m) Kicking

This subtest, together with hopping, was used to determine foot dominance. The child had been asked to place the soccer ball on the floor and kick it to the Candidate and two trials were given. Thereafter the child was engaged in two dynamic kicks, which involved the candidate having kicked the ball to the child, who had to kick the moving ball. The number of times each leg was used was noted. One-sided dominance was given when the child used the same leg for all four tests, or three out of four times. The Candidate had to note when the opposite leg was used as well as the quality of the kick - for example, if the child who had used his right foot three times, and for the last dynamic kick, used the left leg as the ball was closest to the left leg. For the child

who scored two on either foot, this was noted as mixed. This, however was confirmed by asking the child which foot he had played soccer with, as well as obtaining collateral information from the parents.

n) Dominance

Please refer to the subtest on Kicking and Hopping, for detail on the assessment of foot dominance. Foot dominance was finally established by considering the first foot chosen for hopping as well as the foot used for kicking. Where clear dominance was found, the child was marked either right or left-foot dominant, however, where both were used, the child was marked as mixed dominance.

Eye dominance was established by subtest (d), whilst ear dominance subtest (e).

Hand dominance was observed throughout the sessions. The hand used for writing was recorded.

Observations with regards to the hand/s used when throwing and catching the ball, as described by Harris, (1974) were also noted. Collateral information was obtained, by asking the parents the following questions:

(I) Which hand/s does your child eat with ?

(II) Which hand/s does your child use the scissors in?

(III) Which hand/s does your child favour in engaging in general tasks like bathing, brushing his hair, etcetera?

Thereafter a final decision was made as to whether the subject was Right or Left or Mixed/Bilateral hand dominant.

o) Attention and Concentration

This involves the ability of the child to focus on a specific task/ stimulus and sustain attention over a period of time(Arnadottir, 1990). This attribute also involved the ability of the child to screen out irrelevant distractions. There are no formal tests available in order to assess attention and concentration. Kaplan and Sadock (1991), recommend the use of components of larger tests like the Weschler Intelligence Scale for Children (WISC), in order to suggest deficits in this attribute.

These assessments are usually supported by the clinical judgement of the Therapist. Thus the Candidate, using her clinical experience and judgement, observed this attribute throughout the sessions. Criteria were formulated, facilitating the categorization of these children. It was observed that the criteria used for awarding the child a score of three, corresponded to the categorization of Attention Deficit / Hyperactivity Disorder in the Diagnostical and Statistical Manual of Mental Disorders (DSM-IV). Throughout the assessments, it was necessary to take into cognisance the child's chronological age, due to the developmental implications as stipulated in the Manual.

The child who was able to attend and concentrate adequately was scored one.

The mildly distractable child who was; distracted by external stimuli and/or, completing work in a haste and /or, making careless mistakes and /or, talking incessantly, was scored two. In addition, the child with marked fluctuations in standard/scaled scores > three (Refer to Test Manuals on the Interpretation of scores) on similar subtests, for instance on the subtest of Visual Closure on the DTVP and the TVPS were also scored as two.

The child who was distractable by either internal or external stimuli, with poor attention and concentration as well as with the inability to complete tasks, as described by Lerner (1985), was rated three. In addition, the child presented with; difficulty acting out on instructions, difficulty sitting on a chair for a desk top activity-with the tendency to fidget, or wanting to leave the room, impulsiveness as he or she often blurts out answers before the question is completed. This child also presents with the criteria described for the mildly distractable child. Collateral information was also obtained from the parents, as to whether the child follows the instructions given, if the child could sit still and complete tasks at home, and whether he or she was active throughout the day.

p) Understanding of Instructions

According to Lerner (1985), this involves the ability to interpret and respond to instructions throughout the assessment. This also includes information obtained from collateral sources, in this area of functioning.

The child with adequate understanding, who had the ability to execute tasks with ease as

explained by the Candidate and which was appropriate to the test being assessed, will be rated as one. A score of two was given if slight difficulty was noted in the understanding of instructions, which involved the Candidate having to either repeat or demonstrate the instruction to facilitate better understanding. The child would have then executed the task correctly. A score of two would be given if the child had requested repetition of approximately four or less of the instructions.

A score of three was given to children with very poor understanding, who displayed difficulty understanding the instructions even after repetition and explanation by the Candidate.

Physical Assessment

Range of Movement and Muscle Strength

Passive movements and the Muscle Strength Grading System (MRC) acceptable objective measuring instruments for range of movement and muscle strength. The cotton wool is also an acceptable measure of the assessment of tactile sensation.

For the children particularly between four and nine years, the ROM and muscle strength was also assessed through play, as it was difficult obtaining an objective muscle strength assessment of the upper limb. The Candidate found that the children had difficulty keeping still for accurate assessment as well as following the instructions required for muscle strength assessment. In view of this, it was therefore necessary to conduct these assessments on more than one occasion.

The physical performances of these children were observed during the following subtests; throwing and catching a ball, thumb finger touching and diadokokinesis. These subtests are components of Clinical Observations.

The Candidate passively assessed whether there were any muscle or joint contractures in the upper limb. Thereafter the child had to copy each action demonstrated by the Candidate.

These included;

Shoulder - Flexion, extension, abduction, adduction, external and internal rotation.

Elbow -Flexion, extension.

Forearm -Supination and pronation.

Wrist -Flexion and extension

Fingers -Making a fist and extending all fingers and wrist, spreading the fingers apart and then together.

The ability of the child to carry out these demonstrations were rated as mild, moderate and severe restriction of ROM as per Brachial Plexus Assessment Form (Refer to Page 105-106). This is an adapted form, taken from the Assessment Form which is administered to patients with Brachial Plexus Injuries, at King Edward VIII Hospital. Difficulty in gauging the ROM would result in the Candidate engaging the child in various additional activities, with specifications as determined

by the Assessment Form, with reference to the column on Activities of Daily Living.
The Candidate used her clinical experience, of five years in this area, to assist with the assessment.
With reference to the muscle strength assessment, as recorded by the Medical Research Council, (Duthie and Ferguson, 1973), the muscle groups were assessed - Refer to Table IV.

TABLE V

Muscle strength grading, according to the MRC (Duthie and Ferguson, 1973)

GRADE	MUSCLE STRENGTH
Grade **0**	Complete Paralysis
Grade **1**	Flicker of Contraction
Grade **2**	Movement with Gravity Eliminated
Grade **3**	Movement Against Gravity
Grade **4**	Movement Against Resistance
Grade **5**	Normal Muscle power

Muscle strength grading, used to assess the subjects.
Hence the ability of the child to demonstrate the action required by the Candidate in the gravity eliminated and against gravity planes would provide an estimate of the muscle strength.

Taking into cognisance Hunter, et al. (1990) and Seddon (1975), the severities of the lesions were classified as follows;

a) Upper Trunk Lesion

There is paralysis of shoulder abduction, lateral rotation and flexion of the elbow. This child usually has full active ROM of the wrist and the hand.

b) Upper and Middle trunk (C5, 6 and 7)

This lesion includes the deficits of the previous group, with the addition of a loss of active wrist and finger extension, that is an upper trunk lesion plus radial nerve palsy.

c) Lower Trunk Lesion(C8 and T1)

In this lesion there is only loss of hand function - particularly finger flexion and opposition. The

shoulder and elbow function is normal.

d) Mixed Lesion(C5, 6, 7, 8 and T1)

This lesion includes deficits in all three groups, thus including the shoulder, elbow, wrist and fingers.

e) Complete Lesion (C5, 6, 7, 8 and T1)

All cords are involved. The child has a completely flail upper limb.

In instances where an unclear picture was obtained, for example - assessing a child who had previously undergone reconstructive surgery, and having poor medical history notes, a more detailed muscle charting was required.

Thus the children were assessed as described, and matched according to the severity of the lesion. This was later confirmed by the medical file/ Orthopaedic surgeon.

Sensation

Sensation was assessed by comparing the affected with the unaffected limb, which is an acceptable method of assessment.

Tactile sensation was assessed by lightly brushing the skin in an unidirectional manner, with a piece of cotton wool. This was first done on the affected upper limb, and thereafter on the unaffected limb, from proximal to distal. The subject had to state as to whether there was a difference in the feeling between the affected and the unaffected limb, and what the difference was. The Candidate assisted the subject in the decision when he or she expressed difficulty in describing the difference, by suggesting words like 'Dull, faint, strong'.

The sensation was then recorded as Normal or Impaired.

CHECKLIST FOR OBSTETRIC BRACHIAL PLEXUS PALSY ASSESSMENT

[4 TO 10 YEARS]

QUESTIONAIRE	
VMI	
MFPT	
TVPT	
DTVP	
JORDAN'S LEFT-RIGHT REVERSAL TEST	
CLINICAL OBSERVATIONS	
PHYSICAL ASSESSMENT	

[*11 TO 17 YEARS*]

QUESTIONAIRE	
VMI	
TVPT	
JORDAN'S LEFT-RIGHT REVERSAL TEST	
DETROIT TEST (DS,DR,PF)	
CLINICAL OBSERVATION	
PHYSICAL ASSESSMENT	

ANNEXURE IV

ASSESSMENT

PARENTS QUESTIONNAIRE

PLEASE ANSWER THE FOLLOWING DETAILS AND TICK [ ] THE APPROPRIATE ANSWER.

PATIENTS/CHILD'S NAME:_____

OUTPATIENT NUMBER :_____

DATE OF BIRTH :_____
SEX : Boy [ ] Girl [ ]

LANGUAGE : Zulu [ ] Xhosa [ ] English [ ] Other [ ]

POSTAL ADDRESS:_____
_____

TELEPHONE NO: _____
HOW MANY CHILDREN DO YOU HAVE ?_____
WHERE DOES THIS CHILD FIT IN?(for example-2 nd born)_____
DID YOUR CHILD FAIL A YEAR AT SCHOOL ? Yes [ ] No [ ] NA [ ]
PARENTS NAME:_____

PLEASE SUPPLY AGE, EDUCATIONAL LEVEL AND OCCUPATION OF THE FOLLOWING PERSONS IN THE HOME.

	AGE	EDUCATIONAL LEVEL	OCCUPATION
FATHER			
MOTHER			
OTHER (GUARDIAN)			

1.)Are you
a. Single [ ]
b. Married [ ]
c . Divorced [ ]
d Other [ ]

2) Is the mother
- Right Handed [ ]
- Left Handed [ ]

Is the father
- Right Handed [ ]
- Left Handed [ ]

3)Are any of the members of the family learning disabled?
A. Yes [ ]
B. No [ ]

4) What is the approximate total income
a. 0 -R600 [ ]
b. R601 - R1200 [ ]
c. R1201 - R2000 [ ]
d.R2001 - R3000 [ ]
e.R3001 - R5000 [ ]
f.Over R5001 [ ]

5) Do you stay in your
a.Own House [ ]
b.Rented House [ ]
c.Farm [ ]

d.Outbuilding [ ]

6) Who takes care of your child during the day ?

a. Parent [ ]
b. Grandparent [ ]
c. Creche [ ]
d. Others [ ]
e. Nobody [ ]

MEDICAL HISTORY

1)Was the baby born via- a. Normal vaginal delivery [ ]
b. Caesarean Section [ ]
c. Forceps Delivery [ ]
d. Induced Labour [ ]
e. Other [ ]

2)What was the APGAR ratings ? a.Initial [/] Final [/]
b. Uncertain [ ]

3) Did the child cry immediately after it was born?

a. Yes [ ]
b. No [ ]
c. Uncertain [ ]

4)What was the baby's weight? a. Kg [ ]
b. Uncertain [ ]

5)Was the child born at a.Private Hospital [ ]
b.Public Hospital [ ]
c. Clinic [ ]
d.Home [ ]

6)Presentation at birth a.Total loss of movement of limb [ ]
b. Movement of elbow and hand only [ ]
c. Movement of hand(wrist and fingers) only [ ]
d. Movement of fingers only [ ]
e. Slight movement of all joints (Shoulder, elbow and hand.) [ ]
e. Other [ ]

Specify_____

7A) Were the developmental (sitting, standing and walking) motor milestones

a.Normal [ ]
b.Slow [ ]
c.Uncertain [ ]

7B)Was the speech development (understanding, talking),

a. Normal [ ]
b. Slow [ ]
c.Uncertain [ ]

7C)Was the Toileting a. Normal [ ]
b.Slow [ ]
c. Uncertain [ ]

7D) Was the cognitive development(problem solving, memory, understanding of concepts-numbers,body, colours,etc)

a.Normal [ ]
b.Slow [ ]
c.Uncertain [ ]

8)Has your child received any special kind of aid/treatment for his/her problems?

a. Medical/Surgical (Doctor) [ ]
b. Physiotherapy [ ]
c. Speech Therapy [ ]
d. Occupational Therapy [ ]
e. Psychological [ ]
f. Remedial [ ]
g.Other [ ]

9)Did your child suffer from any other medical problem in the past?

a.Yes [ ]
b. No [ ]
c.If yes, specify,_____

10)Does your child suffer from any other medical problem?

a. Yes [ ]
b. No [ ]
c. If yes,specify_____

11)Did your child ever hurt his head seriously ?

a. Yes [ ]
b.No [ ]
a1.If yes, specify_____

Thank you

IMIBUZO KUBAZALI

Phendula lembuzo elandelayo ngokufaka uphawu maqondana nempendulo [ ]:

IGAMA LENGANE : _____

INOMBOLO YAKHE : _____

USUKU LOKUZALWA : _____
UBULILI : UMFANA [ ] INTOMBAZANE[ ]
ULIMI : ZULU[ ] XHOSA[ ] ISINGISI[ ] OLUNYE[ ]
IKHELI LAKHO : _____
_____
UCIGO LWAKHO : _____
USUKU LOKUZALWA : _____
UNABANTWANA ABANGAKI ? : _____
UNGOWESINGALA KUBANTWANA BAKHO : _____
LIKHONA IKLASI AKE ALIPHINDA ESIKOLENI ?: YEBO [ ] CHA [ ]
IGAMA LOMZALI : _____

NIKEZA IMINYAKA , NOMSEBENZI WALABA.

	UBUDALA	IMFUNDO	UMSEBENZI
UBABA			
UMAMA			
NOMYUNE			

1. Kungaba
   a. Awushadile [ ]
   b. Ushadile [ ]
   c.Wehlukanisa [ ]
   d. Wafelwa umyini [ ]

2. Kungabe umama uyi
   - sandla sokudla [ ]
   - sokunxele [ ]

   Kungaba ubaba uyi
   - sandla sokudla [ ]
   - sokunxele [ ]

3.Kungabe ukhona uinin emndenini ofunda ekhubazekile?
   a. Yebo [ ]
   b. Cha [ ]

4. Kunqakube uhola cishe :
   a. 0 - R600 [ ]
   b. R601 - R1200 [ ]
   c. R1201 - R2000 [ ]
   d. R2001 - R3000 [ ]
   e.R3001 - R5000 [ ]
   f. Agaphezu kuka R5001 [ ]

5. Kungaba uhlala
   a. Ekhaya lakho [ ]
   b. Emqashweni [ ]
   c. Epulazini [ ]
   d. Emjondolo [ ]

6. Ubani okubhekela ingane emini?

a. Umzali [ ]
b. Ugogo [ ]
c.Inkulisa [ ]
d. Abanye [ ]
e. Akekho [ ]

Umlando wempilo_____

UMLANDO WEMPILO

1.Kungaba umntwan wazalwa

a. Ngokwejwayelekile [ ]
b. Wahlinzwa [ ]
c. Wakhishelwa [ ]
d. Wasuselwa [ ]
e. Ngenye indlela [ ]

2. Sasi yini isilinganiso sempilo yengane ekuzalweni kwayo ?

a. Esokuqala [/] Esokugcina [/]
b.Angiqinisekanga [ ]

3. Kungabe umntwana wathi ephumananje wakhala ?

a. Yebo [ ]
b. Cha [ ]
c. Awazi [ ]

4. Isisindo sengane eyazalwa naso ?

a. Kg [ ]
b. Awusazi [ ]

5. Kungabe umntwana wazalelwa

a. Esibhedlela sodokotela bangasese [ ]
b. Esibhedlela somphakathi [ ]
c. Emtholampilo [ ]
d. Ekhaya [ ]

6. Wabukeka enjani mhla ezalwa

a.Ingalo ayizange inyakaze nhlobo [ ]
b.Kwanyakaza indolwane nesandla [ ]
c.Kwaba isandla (isihlakala neminwe) [ ]
d.Kwaba iminwe kuphela [ ]
e.Kwanyakazo kancane wonke amalunga (Ihlombe, indololwane, nesandla) [ ]
f. Okunye [ ]

Kuehaze _____

7A.Ukukhula (ukuhlala, ukuma nokuhamba) kwaba

a. Okufanele [ ]
b. Kweza kancane [ ]
c. Awusazi [ ]

7B. Kungabe ukaqala ukukhuluma (ukuzwa, ukukhuluma) kwezeka ngesikhathi

a. Esifanele [ ]
b. Wephuza [ ]
c. Awusazi [ ]

7C. Ukuya endlini encane wakwenza -

a. Ngokufanele [ ]
b. Wephuza [ ]
c. Awusazi [ ]

7D. Kungabe umqondo wakwazi ngoku fanele ukuxazulula izinking (ukukhumbula izinto; ukwazi izinombolo ngokulandelana; umzimba; imibala nokunye wakwenza),

a. Ngokufanele [ ]
b.Wephuza [ ]
c. Awusazi [ ]

8. Kungabe umntwana wakho waluthola usizo/wezinkinga zalokhu?

a. Ukuzula [ ]
b.Ukululwa [ ]
c. Ukukhulungiswa [ ]
d. Ukulungiswa imizwa [ ]
e. Inzgondo [ ]
f.Nkulashwa [ ]
g. Nokunge [ ]

9. Kungabe umntwana wakho wake wagula ngokomzimba ngaphambilini ?

a. Yebo [ ]
b. Cha [ ]
c. Uma kunjalo chaza [ ]

10. Kungabe umntwa wakho unenkinga ngokwempilo ?

a. Yebo [ ]
b.Cha [ ]
c. Uma kunjalo chaza [ ]

11. Kungabe umntwana wakho wake walimale kabi ekhanda ?

a. Yebo [ ]
b. Cha [ ]
c. Uma kunjalo chaza,_____

NGIYABONGA

BRACHIAL PLEXUS ASSESSMENT FORM - (Component of the Brachial Plexus Assessment Form, used at King Edward VIIIth Hospital)

MUSCLE		ACTION	RCM		MUSCLE STRENGTH		ACTIVITIES OF DAILY LIVING
SCAPULAR							
1. Lerator Scapular (dorsal scapular)	C_{345}	Elevation					OVERHEAD ACTIVITIES
2. Latissimus Dorsi (thoraco-dorsal)	C_{678}	Depression					
3. Rhomboids (dorsal scapular)	C_{56}	Adduction					
4. Serratus Anterior (long thoracic)	C_{567}	Abduction					
SHOULDER							
1. Supraspinatus (suprascapular)	C_{56}	Abduction					SHOULDER HEIGHTS
2. Middle Deltoid (axillary)	C_{56}						HORIZONTAL TO OVERHEAD
3. Lattissimus Dorsi (thoraco-dorsal)	C_{6-8}						AND DESK HEIGHT ACTIVITIES
4. Teres Maior (lower subscapular)	C_5-T_1	Abduction					
5. Pect Maior (sternal costa) (pectoral)	C_5-T_1						
6. Anterior Deltoid (axillary)	C_{56}						
7. Corachobrachialis (musculocutaneous)	C_{56}	Flexion					
8. Pect Maior (Clavicular)(pectoral)	C_5-T_1						
9. Biceps (musculocutaneous)	C_{56}						
10. Lattisimus Dorsi (thoraco-dorsal)	C_{6-8}						
11. Teres Mjor (lower subscapular)	C_5-T_1	Extension					
12. Posterior Deltoid (axillary)	C_{56}						
13. Triceps-long head (radial)	C_7-T_1						
14. Subscapularis (subscapular)	C_{6-8}						
15. Teres Maior (lower subscapular)	C_{56}	Intrnal					
16. Latissimus Doris (thoraco-dorsal)	C_{6-8}	Rotation					
17. Pect Major (pectoral)	C_5-T_1						
18. Anterior Deltoid (axillary)	C_{56}						
19. Infrascinatus (suprascapular)	C_{56}						
20. Teres Minor (axillary)	C_{56}	External					
21. Posteror Deltoid (axillary)	C_{56}	Rotation					
22. Posterior Deltoid (axillary)	C_{56}	Horizontal Abduction					
23. Pect Maior (pectoral)	C_5-T_1	Horizontal					
24. Ant Deltoid (axillary)	C_{56}	Abduction					
ELBOW							
1. Biceps (musculocutaneous)	C_{56}						REACHING & PLACING
2. Brachioradialis (radial)	C_{56}	Flexion					
3. Brachialis (musculocutaneous	C_{56}						
4. Triceps (radial)	C_7-T_1	Extension					
FOREARM							
1. Sucinator (radial)	C_{56}						
2. Biceps (musculocutaneous)	C_{56}	Supination					
3. Pronator Teres (median)	C_{67}						
4. Pronator Quadratus (median)	C_8-T_1	Pronation					

MUSCLE		ACTION	ROM		MUSCLE STRENGTH		ACTIVITIES OF DAILY LIVING
WRIST							
1. ECRL (radial)	C_{6-8}						
2.ECRB (radial)	C_{6-8}	Extension					
3. ECU (radial)	C_{7-8}						
4. FCR (median)	C_{6-8}						
5. Palmaris Longus (median)	C_7-T_1	Flexion					
6. FCU (ulnar)	C_{6-8}						
FINGERS							
1. Flexor Superficialis (1st) (median)	C_7-T_1						PREHENSILE AND
2. Flexor Superficialis (2nd) (median)	C_7-T_1	MP, PIP					NON PREHENSILE TASKS
3. Flexor Superficialis (3rd) (median)	C_7-T_1	Flexion					
4. Flexor Superficialis (4th) (median)	C_7-T_1						
5. Flexor Profundus (1st) (median)	C_8-T_1						
6. Flexor Profundes (2nd) (median)	C_8-T_1	MP, DIP					
7. Flexor Profundes (3rd) (ulnar)	C_8-T_1	FLEXION					
8.Flexor Profundus (4th) (ulnar)	C_8-T_1						
9. Flexor Digiti Minimi (5th) (ulnar)	C_8-T_1	DIP Flexion					
10.Extensor Digitorium(1st) (radial)	C_7-T_8						
11.Extensor Digitorium (2nd) (radial)	C_7-C_8						
12.Extensor Digitorium (3rd) radial)	C_7-C_8	MP					
13.Extensor Digitorium (1st) (radial)	C_7-C_8	EXTENSION					
14.Ext.Digiti Minimi (5th) (radial)	C_7-C_8						
15.Lumbricals (1st) (median)	C_9-T_1						
16.Lumbricals (2nd) (median)	C_8-T_1	IPJ					
17.Lumbricals (3rd) (ulnar)	C_8-T_1	EXTENSION					
18.Lumbricals (4th) (ulnar)	C_8-T_1						
19. Dorsal Interosseus (1st) (ulnar)	C_8-T_1						
20.Dorsal Interosseus (2nd) (ulnar)	C_8-T_1	MP Flexion					
21.Dorsal Interosseus (3rd) (ulnar)	C_8-T_1	ABDUCTION					
22.Dorsal Interosseus (4th) (ulnar)	C_8-T_1						
23.Abd.digiti Minimi (5th) (ulnar)	C_8-T_1	Abduction					
24.Palmer Interosseus (1st) (ulnar)	C_8-T_1						
25.Palmer Interosseus (2nd) (ulnar)	C_8-T_1	ABDUCTION					
26.Palmer Interosseus (3rd) (ulnar)	C_8-T_1						
THUMB							
1. FPL (median)	C_7-T_1	MP + IP					
2. FPB (median & ulnar)	C_8-T_1	FLEXION					
3.EPL (radial)	C_{78}	MP + IP					
4.EPB (radial)	C_{78}	EXTENSION MP					
5. APL (radial)	C_{78}	ABDUCTION					
6.APB (median)	C_7-T_1						
7.Adductor Pollicis (ulnar)	C_8-T_1	ABDUCTION					
8.Opponens Pollicus (median)	C_8-T_1						
9.Oppenens Digiti Minimi (ulnar)	C_8-T_1	OPPOSITION					

KEY FOR ROM

5%	**-**	**39%**	**OF ACTIVE MOVEMENT**	**-**	**SEVERE RESTRICTION OF ROM**	**[S]**
40%	**-**	**69%**	**OF ACTIVE MOVEMENT**	**-**	**MODERATE RESTRICTION OF ROM**	**[O]**
70%	**-**	**90%**	**OF ACTIVE MOVEMENT**	**-**	**MINIMAL RESTRICTION OF ROM**	**[M]**
0%			**FIXED DEFORMITIES**			**[*]**

COMMENTS:.....

.....

KING EDWARD VIII HOSPITAL

SUMMARY OF OCCUPATIONAL THERAPY ASSESSMENT FINDINGS

PATIENT NAME:_____
PATIENT NO:_____
CHRONOLOGICAL AGE: [ ] Years [ ]Months
SEX : Male [ ] Female [ ]
ARM AFFECTED : Right[ ] Left [ ]

1.VMI

Raw score :[ ]
Percentile :[ ]
Age equivalent :[ ]Years [ ]Months
Scaled Score :[ ]
Standard Score :[ ]

2.MFPT

Raw Score :[ ]
Percentile Quotient :[ ]
Age Equivalent :[ ]Years [ ]Months

3.DTVP

[A]

3.1 Eye hand Coordination ; Std Score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.2 Position in Space ; Std Score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.3Copying ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.4Figure ground ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.5 Spatial Relations ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.6Visual Closure ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.7 Visual Motor speed ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.8Form Constancy ; Std score :[ ]
%tile :[ ]
Age Eq. :[ ]Years [ ]Months
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

[B]
Composite Scores

3.1 General Visual Perception ; Quotient :[ ]
%tile :[ ]
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.2Motor Reduced Visual Perception ; Quotient :[ ]
%tile :[ ]
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

3.3Visual Motor Integration ; Quotient :[ ]
%tile :[ ]
Rating :[1] Very superior [ ]
[2] Superior [ ]
[3] Above Average[ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Very Poor [ ]

4. TVPS(NON MOTOR)

4.1Visual Discrimination ; Scaled Score :[ ]
%tile Rank :[ ]
Perceptual age : [ ] years [ ]months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

4.2Visual Memory ; Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ] Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

4.3 Visual Spatial Relations ; Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ] Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]

[4] Below Average [ ]
[5] Low [ ]

4.4 Visual Form Constancy ;

Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ] Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

4.5 Visual Sequential Memory ;

Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ]Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

4.6 Visual Figure Ground ;

Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ]Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

4.7Visual Closure ;

Scaled Score :[ ]
%tile Rank :[ ]
Perceptual Age : [ ]Years [ ]Months
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

Overal :
Sum of scaled Scores :[ ]
Perceptual Quotient : [ ]
Percentile Rank : [ ]
Rating : [1]Superior [ ]
[2] Above Average [ ]
[3] Average [ ]
[4] Below Average [ ]
[5] Low [ ]

:

5. Jordans Left-Right Reversal Test

Error Score - Level I :[ ]
Level II :[ ]
Level III :[ ]
Total Error Score :[ ]
Percentile :[ ]
Modal Percentile for Age group : [ ]

Score falls within the Normal Limits :[ ] or
Below the Normal Limits :[ ]

6. Detroit Test of Learning Aptitude

6.1Design Sequences ;

Raw Score: [ ]
%tile : [ ]
St.Score : [ ]
A.Equiv. : [ ]Years [ ]Months
Rating : [1]Very Superior [ ]
[2]Superior [ ]
[3] Above Average [ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Vey Poor [ ]

6.2 Design Reproduction ;

Raw Score: [ ]
%tile : [ ]
St.Score : [ ]
A.Equiv. : [ ]Years [ ]Months
Rating : [1]Very Superior [ ]
[2]Superior [ ]
[3] Above Average [ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Vey Poor [ ]

6.3 Picture Fragments ;

Raw Score: [ ]
%tile : [ ]
St.Score : [ ]
A.Equiv. : [ ]Years [ ]Months
Rating : [1]Very Superior [ ]
[2]Superior [ ]
[3] Above Average [ ]
[4] Average [ ]
[5] Below Average [ ]
[6] Poor [ ]
[7]Vey Poor [ ]

7.Clinical Observation and General Observations

7.1 Dominance ;

Eye : Right[ ] Left[ ] Both[ ]
Ear : Right [ ] Left[ ] Both[ ]
Hand:Right[ ] Left[ ] Both[ ]
Foot :Right[ ] Left[ ] Both[ ]

The key used to score the following items were :
3=Normal Function 2=Slightly Deficient 1=Definitely Deficient

7.2Eye Movements
- In general : [ ]
-Across midline : [ ]
-Convergence : [ ]
-Quick Localization : [ ]

7.3 Slow Movements : [ ]

7.4 Thumb Finger Touching

- Right : [ ]
-Left : [ ]
-Both : [ ]

7.5 Diadokokinesia
-Right : [ ]
-Left : [ ]
-Both : [ ]

7.6 Co-contraction
-Upper Limbs : [ ]

7.7Equilibrium Reactions
-Standing : [ ]

7.8Throwing : [ ]

7.9Catching : [ ]

7.10.1Walking on a Line : [ ]
7.10.2Hopping on a line
7.10.2.1-Right Foot : [ ]
7.10.2.2-Left Foot : [ ]

7.11 Attention and Concentration : [ ]

7.12 Understanding of Instructions : [ ]

Overall Clinical Observations Performance
No Sensory Integrative Deficits [ ]
Mild to Moderate Sensory Integrative Deficits [ ]
Severe Sensory Integrative Deficits [ ]

8.Physical Assessment

8.1 CLASSIFICATION

LESION	**MYOTOME**	[ ]
UPPER TRUNK LESION	C5 - C6	
UPPER AND MIDDLE TRUNK LESION	C5 - C6 - C7	
LOWER TRUNK LESION	C8 - T1	
MIXED LESION	C5 - C6 - C7 - C8 - T1	
COMPLETE LESION	C5 - C6 - C7 - C8 - T1	

8.2 SUMMARY OF PHYSICAL FUNCTION

8.2.1**Sensation**
8.2.1.1 Normal [ ]
8.2.1.2 Impaired [ ]

ANNEXURE V

ADDITIONAL RESULTS

ADDITIONAL RESULTS

4.4.1 Below Average Performance on Subtests

TABLE XI

Chi Square Results for establishing the relationship between below average performance on Subtests in the sample and against the normal population.

SUBTEST	SUBJECTS n=a/b	% BELOW AVERAGE	CHI SQUARE (p)	SIGNIFICANT(S)/ BORDERLINE(B)/ NOT SIG.(NS_)
1.Eye Motor Co-ordination	11/20	55	0,01	S
2.Position in Space	11/20	55	0,01	S
3.Visual Closure	12/20	60	0,003	S
4.Visual Motor Speed	14/20	70	0,001	S
5.Visual Form Constancy	8/19	48	0.02	S
6.Visual Sequential Memory	9/19	48	0,02	S
7.*Design Sequences	6/7	85,7	0,03	S

KEY:

n - Total number of subjects

a - Number of subjects who had performed below average per test

b - Total number of patients assessed per test

The results that were not significant have been excluded.

The Table indicates statistically significant below average performance on all the above subtests.

It must be noted that although the performance on the subtest of the DTLA-3, being design sequences was significant, the test score must be interpreted with caution due to the small sample size assessed on this test.

4.4.2. Attention and Concentration

FIGURE VII

ATTENTION AND CONCENTRATION

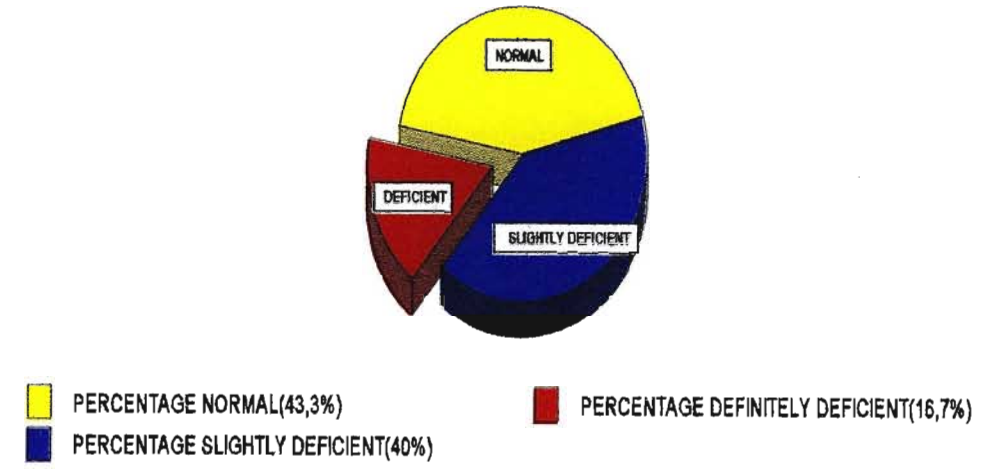


Figure VII indicates that attention and concentration of the subjects appeared to be deficient in 56,7% of the sample.

4.4.3. Dominance

TABLE XII

Arm/s affected against dominant hand/s of Subjects, and dominance against parent handedness.

	DOMINANT HAND *(Bilateral)*	**DOMINANT HAND** *(Left)*	**DOMINANT HAND** *(Right)*
AFFECTED ARMS *(Bilateral)*	0	1(3,3%)	0
AFFECTED ARM *(Left)*	1(3,3%)	0	16(53,3%)
AFFECTED ARM *(Right)*	2(6,67%)	10(33,3%)	0
Relationship of children to 95% of the Right-Handed parents	3(13,64%)	8(36,36%)	11(50%)

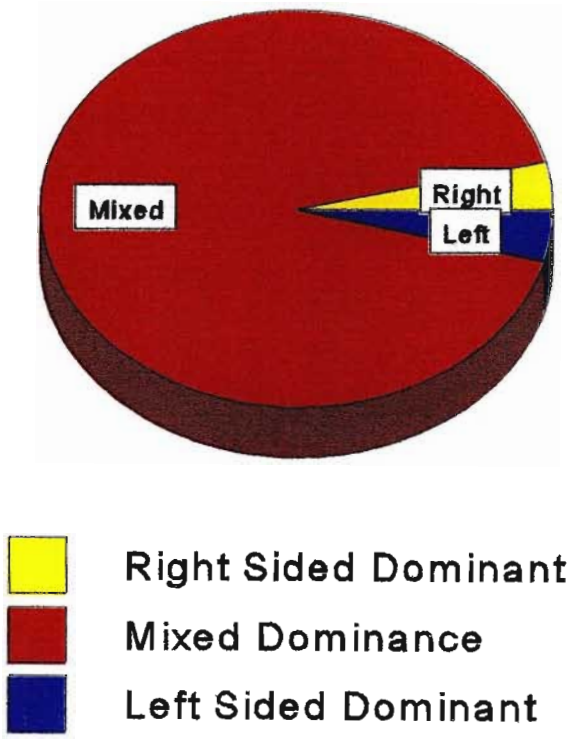
Table indicating the number and percentage(%) of subjects having their right, left or bilateral arms affected by the injury; against the presenting hand/s which appear dominant.

According to the Table there appears to be a tendency of the opposite hand to the affected hand in becoming dominant. This means that it is likely that when the left-hand is affected the child becomes right-handed and when the right-hand is affected the child becomes left-handed.

95% of the parents were right-handed and of these parents, 13,64% were mixed dominant, 36,6% were left and 50% right.

FIGURE VIII

DOMINANCE FOR HAND, EAR, EYE AND FOOT



The Figure VIII indicates that majority of the subjects presented with mixed dominance.

TABLE XIII

Comparison between the left-hand and the right-hand dominant subject's below average test performance, being born from right-hand dominant parents

TEST	% LEFT DOMINANT	(L) n= a/b	%RIGHT DOMINANT	(R) n= c/d	CHI SQUARE (p)	S/ B/ NS
VMI (Test)	37,5	3/8	9,09	1/11	0,1	B
DTVP-GVP	50	3/6	37	3/8	0,5	NS
DTVP-MRVP	83,33	5/6	37,5	3/8	0,1	B
DTVP-VMI	50	3/6	50	4/8	0,7	NS
MFPT	75	3/4	25	1/4	0,2	NS
TVPS	75	6/8	27,27	3/11	0,05	S
DS	100	2/2	75	3/4	0,667	NS
DR	50	1/2	25	1/4	0,6	NS
PF	100	2/2	50	2/4	0,4	NS
JORDANS L-R	100	5/5	42,86	3/7	0,07	S
CLIN.OBS	87,5	8/11	72,73	7/8	0,43	NS

Key:

% RIGHT-DOMINANT - Percentage of right-hand dominant subjects, who had scored below average (having right-hand dominant parents)

%LEFT-DOMINANT - Percentage of left-hand dominant subjects, who had scored below average (having right-hand dominant parents)

n - Number of subjects

a - Number of left-hand dominant subjects, who had performed below average per test

b - Number of left-hand dominant subjects per test

c - Number of right-hand dominant subjects, who had performed below average per test

d - Number of right-hand dominant subjects per test

S - Significance

B - Borderline

NS - No Significance

CLIN. OBS. - Clinical and General Observations

Table XV indicates significant below average scores on the TVPS and Jordan's L - R, borderline significance on MRVP Composite Score of the DTVP and the VMI Test.

4.4.4. Socio economic Status

TABLE XIV

Classification of breadwinner's occupation, (Riordan, 1978)

OCCUPATIONAL CLASSIFICATION	SCORE
Top professional, executive, administrative and technical occupations	9
Professional, administrative and managerial workers	8
Independent commercial	7
Lower grade administrative and managerial workers	6
Artisans and skilled workers with trade qualifications	5
Routine clerical and administrative workers, service and sales workers	4
Semi-skilled production and manual workers	3
Unskilled production and manual workers	2
Not economically active or productive	1
No response	0

TABLE XV

Classification of breadwinner's education (Riordan, 1978)

FATHER'S EDUCATION	SCORE
University attendence	7
Post-Matric training(Not University)	6
Matric	5
Apprentice	4
Junior Certificate	3
Primary School	2
None at all	1
No response	0

TABLE XVI

Classification of socio economic status (Riordan, 1978)

	LOWER	MIDDLE	UPPER
BLACK	2 3 4 5	6 7 8 9 10	11 12 13 14 15 16
COLOURED	2 3 4 5 6	7 8 9 10	11 12 13 14 15 16
INDIAN	2 3 4 5 6	7 8 9 10	11 12 13 14 15 16
WHITE	2 3 4 5 6 7 8 9 10	11 12 13	14 15 16

TABLE XVII

Socio economic status classification of parents.

SOCIO ECONOMIC STATUS		
LOWER	***MIDDLE***	***UPPER***
29,2%	37,5%	33,3%
(7)	(9)	(8)

Frequency missing is 6.

Key:

% - Percentage

( ) - The numbers within the brackets represent the number of subjects falling in the specific category.

The Table indicates that most of the subjects came from the Middle Class, but however there appears to be a relatively proportionate number in each category.

TABLE XVIII

Comparison of mean test scores between socio economic status groups

TEST	(N) IN LOW SES GROUP [a/b]	(N) IN MIDDLE & HIGH SES GROUP [c/b]	T test (p)	SIGNIFICANT(S)/ BORDERLINE(B)/ NOT SIGNIFICANT(NS)
VMI Test	8/30	16/30	0,002	S
MFPT	4/12	8/12	0,08	B
DTVP - GVP	6/18	12/18	0,02	S
- MRVP	6/18	12/18	0,05	S
-VMI	6/18	12/18	0,21	NS
TVPS	8/23	15/23	0,03	S
DS	3/7	4/7	0,18	NS
DR	3/7	4/7	0,22	NS
PF	3/7	3/7	0,27	NS
Jordan's L-R	5/16	11/16	0,35	NS

KEY:

(N) - Number of subjects

[a/b] - Where **a** is the number of subjects in the low socio economic group ,who had been assessed on the particular test.

- Where **b** is the total number of subjects assessed per test.

[c/d] - Where **c** is the number of subjects in the middle and upper socio economic group, who had been asssessed on the particular test.

Table XVIII indicates a significant difference in test scores between the low, and the middle and upper socio economic status groups.This is evident on the VMI, DTVP- GVP and MRVP, and TVPS. Borderline significance exists on the MFPT.

4.4.5. Birth cry

TABLE XIX

Classification of subjects according to whether they cried immediately at birth.

	NUMBER &PERCENTAGE OF SUBJECTS	
Cried Immediatly	11	40,7%
Did not cry	12	44,7%
Uncertain	4	14,8%

Table indicating a significant percentage of subjects who had cried, as well as did not cry immediately after birth - according to the parent's questionnaire.

TABLE XX

Significant associations of scores, between below average test scores and subjects who did not cry

TEST	NUMBER OF SUBJECTS N= [a/b]	CHI SQUARE (p)
MFPT	5/12	0,02
TVPS	10/23	0.004

According to Table XX, the subjects who did not cry immediately after birth, performed significantly poorer on the MFPT and the TVPS.

4.4.6. Familial History of Learning Disabilities

TABLE XXI

Classification of subjects who presented with a familial history of learning disability

	NUMBER & PERCENTAGE OF PARENTS	
Familial history	5	16,67
No familial history	35	83,33

The table indicates that (5)16,67% of the subjects came from families with learning disabilities.

4.4.7. Birth Weight

TABLE XXII

Classification of subjects according to birth weight

NUMBER OF SUBJECTS	PERCENTAGE OF SUBJECTS	RANGE OF BIRTH WEIGHT(kg)
12	52,2	3 to 4
11	47,8	4,05 to 5,5

Key:

kg - Kilograms

The subjects birth weight ranged between 3 and 5,5 kilograms.

4.4.8. Developmental Milestones

TABLE XXIII

Classification of subjects according to developmental milestones.

	NUMBER & PERCENTAGE OF SUBJECTS	
Normal developmental milestones	20	76,9
Delayed developmental milestones	4	15,4
Uncertain	2	7,7

Table XXIII indicates that a significant percentage of parents had reported that their child displayed normal developmental milestones.

4.4.9. Medical History and Treatment

TABLE XXIV

Classification of subjects according to medical history

	NUMBER & PERCENTAGE OF SUBJECTS	
No medical problem	23	82,1%
Medical problem	5	17,9%

Table XXIV indicates that (5)17,9 % of the subjects presented with additional medical problems like epilepsy, asthma and thyroid malfunction.

TABLE XXV

Classification of subjects receiving medical treatment

MEDICAL TREATMENT RECEIVED	NUMBER OF SUBJECTS	PERCENTAGE OF SUBJECTS
Medical/Surgical (Doctor)	30	100
Physiotherapy	28	93,3
Speech Therapy	4	13,3
Occupational Therapy	29	96,7
-Receiving visual perceptual therapy	8	26,7
- Requiring visual perceptual therapy	27	90
Psychological	3	10
Remedial	1	3,3

According to the table, all the children received treatment from the Doctor. Of those children receiving Occupational Therapy, 26,7 % had already received visual perceptual therapy prior to the assessment, whilst in total 90% of the subjects were in fact requiring visual perceptual therapy.

4.4.10. School Performance

TABLE XXVI

Classification of subjects according to school performance

SCHOOL PERFORMANCE	NUMBER OF SUBJECTS	PERCENTAGE OF SUBJECTS
Failed at school	5	17,9
Passed	19	67,9
Not applicable	4	14,3

The table indicates that (5) 17,9 % of the OBPP subjects failed at school. The 14,3% of subjects of which this classification did not apply to were not yet at school.

4.4.11. BIRTH ORDER

Birth order was not specific, and no significant correlation was reported between the first and fourth births to left handedness, contrary to the reports by Bakan (Annett and Ockwell,1980).