CONVERGENT VALIDITY OF THE OCCUPATIONAL THERAPY ADULT PERCEPTUAL SCREENING TEST WITH TWO OTHER COGNITIVE-PERCEPTUAL TESTS IN SOUTH AFRICA

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Occupational Therapy.

Johannesburg, 28 August 2014

DECLARATION

I, Fadzai Razemba declare that this dissertation is my own work. It is being submitted for the degree of Master of Science in Occupational Therapy to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Signed:

_____ Day of _____, 2014

DEDICATION

For my husband and family with love.

PRESENTATIONS ARISING FROM THE RESEARCH

Convergent Validity of the Occupational Therapy Adult Perceptual Screening Test by Occupational Therapy Africa Regional Group (OTARG) Conference held in August 2013, Zimbabwe (Razemba, Jacobs et al. 2013)

Razemba, F., L. Jacobs, et al. (2013). Convergent Validity of the Occupational therapy Adult Perceptual Screening Test with two other cognitive-perceptual tests in South Africa. Occupational Therapy Africa Regional Group. Harare, Zimbabwe.

ABSTRACT

In previous research done, convergent validity was not established for OT-APST with two cognitive-perceptual tests. In this research, the DLOTCA and RPAB were used as reference tools to determine the convergent validity of the OT-APST using Spearman's correlation. The aim was to ascertain whether the three tests when administered at the same time would yield the same result. This was a quantitative cross-sectional study that was mainly correlative and comparative in nature. Convenience sampling was used (n=32). The tools compared evaluate similar constructs and were expected to have strong correlations. This current research revealed that six subscales of the OT-APST had significant correlations with similar cognitive areas from the DLOTCA and the OT-APST subscales often correlated with an appropriate item from the RPAB. This study provides sufficient evidence of the convergent validity of the OT-APST when compared to the DLOTCA and RPAB. The OT-APST proved useful in identifying patients with visual perceptual problems in a population not standardised for.

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TABLE OF CONTENTS

CONVERGENT VALIDITY OF THE OCCUPATIONAL THERAPY ADULT PERCEPTUAL SCREENING TEST WITH TWO OTHER COGNITIVE-PERCEPTUAL TESTS IN SOUTH AFRICA i

PRESENTATIONS ARISING FROM THE RESEARCH iv

ABSTRACT v

ACKNOWLEDGEMENTS vi

LIST OF FIGURES xii

LIST OF TABLES xiii

OPERATIONAL DEFINITIONS xv

ABBREVIATIONS xvi

CHAPTER 1 1

INTRODUCTION 1

1.1 Background and Need 1

1.2 Problem statement 3

1.3 Research question 3

1.4 Aim 3

1.5 Objectives 4

1.6 Justification 4

CHAPTER 2 5

LITERATURE REVIEW 5

INTRODUCTION 5

2.1 Stroke 5

2.2 Cognition 7

2.3 Visual perception 8

2.3.1 Components of visual cognitive perception 9

2.3.2 Agnosia 10
2.3.3 Reading 12
2.3.4 Visuospatial Relations 12
2.3.5 Praxis 13
2.3.6 Constructional skills 14
2.3.7 Acalculia 15
2.4 Cognitive-perceptual tools 15
2.4.1 Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) 16
2.4.2 Rivermead Perceptual Assessment Battery 17
2.4.3 Screening 18
2.5 Validity 20
2.6 Conclusion 21
CHAPTER 3 22
METHODOLOGY 22
INTRODUCTION 22
3.1 Study design 22
3.2 Subjects 22
3.2.1 Sampling 22
3.2.2 Sample size 23
3.2.3 Inclusion criteria 23
3.2.4 Exclusion criteria 24
3.3 Measurement Instruments 24
3.4 Procedure 25

3.5 Data Analysis 28

3.6 Variables 29

3.7 Ethical Considerations 29

3.8 Budget 30

3.9 Timeline 30

CHAPTER 4 31

RESULTS 31

INTRODUCTION 31

4.1 Demographics 31

4.1.1 Sample 31

4.1.2 Distribution of participants according to the hospitals 31

4.1.3 Distribution of participants according to gender 32

4.1.4 Distribution of participants according to age 33

4.1.5 Hand dominance of participants 33

4.1.6 Distribution of participants according to the hemispheric side of the stroke 34

4.1.7 Order of tool administration 34

4.2 Comparison of tools 35

4.2.1 Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) and Rivermead Perceptual Assessment Battery (RPAB) compared to the Occupational Therapy Adult Perceptual Screening Test (OT-APST) 36

4.2.2 Subscales correlations 53

CHAPTER 5 58

Discussion 58

INTRODUCTION 58
5.1 Demographic characteristics of participants 58
5.2 Cognitive-perceptual assessment and screening tools 59
5.3 Theoretically similar constructs 60
5.4 Comparison of individual OT-APST items 61
5.4.1 OT-APST Agnosia individual items 61
5.4.2 OT-APST Visuospatial relations individual items 68
5.4.3. Praxis individual items 74
5.4.4. OT-APST Constructional skills Individual items 76
5.4.5. OT-APST Acalculia individual item 79
5.5. Comparison of Subscales of the OT-APST 79
5.5.2. Agnosia subscale 79
5.5.3. Body scheme subscale 80
5.5.4. Unilateral neglect subscale 81
5.5.5. Praxis subscale 81
5.5.6. Constructional subscale 82
5.5.7. Acalculia 83
CHAPTER 6 84
CONCLUSION 84
6.1 Limitations 86
6.2 Recommendations for further studies 86
References 87
APPENDICES 93
APPENDIX A: OT-APST 93

APPENDIX B: DLOTCA 94
APPENDIX C: RPAB 95
APPENDIX D 97
APPENDIX E 99
APPENDIX F 101
APPENDIX G 102
APPENDIX H 106
APPENDIX I 107
APPENDIX J 108
APPENDIX K 109

LIST OF FIGURES

Figure 4.1 Distribution of the participants who participated according to hospitals (n=32) 32

Figure 4.2 Distribution of the participants according to gender (n=32) 32

Figure 4.3 Distribution of the participants according to their age (n=32) 33

Figure 4.4 Distribution of participants according to hand dominance (n=32) 33

Figure 4.5 Distribution of participants according to the side of the stroke (n=32) 34

Figure 4.6 Graphic representation of the order of tool administration 35

LIST OF TABLES

Table 4.1 Moderate to Strong Correlations between the raw scores of the OT-APST Colour Naming item and DLOTCA items..... 37

Table 4.2 Correlations between the OT-APST Colour naming item and RPAB items..... 37

Table 4.3 Correlations between the OT-APST Shape Constancy item and DLOTCA items 38

Table 4.4 Correlations between the OT-APST Shape constancy item and RPAB items.. 38

Table 4.5 Correlations between the OT-APST Figure-Ground item and DLOTCA items . 39

Table 4.6 Correlations between the OT-APST Figure-Ground item and RPAB items..... 39

Table 4.7 Moderate to high correlations between the OT-APST Reading item and DLOTCA items..... 40

Table 4.8 Moderate Correlations between the OT-APST Reading item and RPAB items 40

Table 4.9 Correlations between the OT-APST Body Parts-self and DLOTCA items..... 41

Table 4.10 Correlation between the OT-APST Body Parts-Self item and RPAB item..... 41

Table 4.11 Correlation between the OT-APST Body Parts-Therapist item and DLOTCA items..... 42

Table 4.12 Correlations between the OT-APST Left/Right on Self item and DLOTCA items 43

Table 4.13 Correlation between the OT-APST Directions/Position item and DLOTCA items 43

Table 4.14 Correlations between the OT-APST Clock item and DLOTCA items 44

Table 4.15 Correlations between the OT-APST House item and DLOTCA 45

Table 4.16 Correlations between the OT-APST House item and RPAB items..... 46

Table 4.17 Correlations between the OT-APST 2 Dimensional Construction item and DLOTCA items..... 48

Table 4.18 Correlations between the OT-APST 2 Dimensional Construction item and RPAB items 49

Table 4.19 Correlations between the OT-APST 3 Dimensional Construction item and DLOTCA items..... 50

Table 4.20 Correlations between the OT-APST 3 Dimensional Construction item and RPAB items 51

Table 4.21 Correlations between the OT-APST Calculations item and DLOTCA items... 52

Table 4.22 Correlations between the OT-APST Facial gesture item and DLOTCA items 53

Table 4.23 Correlations between the OT-APST Agnosia subscale and the DLOTCA cognitive areas and the individual RPAB corresponding items..... 54

Table 4.24 Correlations between the OT-APST Body scheme subscale and the DLOTCA cognitive area and individual RPAB items..... 54

Table 4.25 Correlations between the OT-APST Unilateral Neglect subscale and the individual reference tool items..... 55

Table 4.26 Correlations between the OT-APST Praxis subscale and DLOTCA Praxis cognitive area and RPAB item 55

Table 4.27 Correlations between the OT-APST Constructional subscale and DLOTCA cognitive areas and individual RPAB items 56

Table 4.28 Correlations between the OT-APST Acalculia subscale and the DLOTCA cognitive area and Verbal Mathematical Questions item..... 57

OPERATIONAL DEFINITIONS

Perception : the process of incorporating and organizing information received from the environment via sensory impulses into a mental representation of the meaning (Akbari, Ashayeri et al. 2011)

Screening tool : an instrument used to distinguishing patients with a condition or impairment from those without (Bonita, Beaglehole et al. 2006)

ABBREVIATIONS

ADL : Activity of Daily Living

Cognistat : Neurobehavioural Cognitive Status Examination

CHBAH : Chris Hani Baragwanath Academic Hospital

CMJAH : Charlotte Maxeke Johannesburg Academic Hospital

DLOTCA : Dynamic Loewenstein Occupational Therapy Cognitive Assessment

DTVP-A : Developmental Test of Visual Perception- Adolescent and Adult

LOTCA : Loewenstein Occupational Therapy Cognitive Assessment

LOTCA –G : Loewenstein Occupational Therapy Cognitive Assessment-Geriatric

OT-APST : Occupational Therapy Adult Perceptual Screening Test

RPAB : Riverhead Perceptual Assessment Battery

CHAPTER 1
INTRODUCTION

1.1 Background and Need

In South Africa, the prevalence of stroke for people from 15 years and older, is 3 for every 1 000 (Connor 2004). Stroke negatively influences an individual's ability to have an active and independent life (Jones and Shinton 2006). Of the patients suffering from stroke, 1 in 500 will require help with at least one activity of daily living (ADL) (Connor 2004), and this may be as a result of motor, sensory, cognitive or perceptual deficits (Mercier, Audet et al. 2001).

Desmond, et al, found that 35,2% of patients who had a stroke had cognitive impairments (Desmond, Moroney et al. 1996). Cognitive impairments which are often associated with stroke include attention, orientation, spatial abilities and executive abilities (Srikanth, Thrift et al. 2003), (Tatemichi, Desmond et al. 1994). A number of deficits concerning vision can also arise as a result of stroke, including decreased visual acuity, disorders of eye movement, retinal abnormalities, visual field defects and visual perceptual problems (Jones and Shinton 2006). In a study by F. Rowe, et al, 20,5% of the patients referred for visual assessments had perceptual deficits with the majority having visual neglect (Rowe, Brand et al. 2009). The visual perceptual problems arising from stroke can affect functional vision which is essential for independent living (Brown, Mullins et al. 2009), thus impacting an individual's life and affecting areas like work, recreation and self-care (Paolucci, McKenna et al. 2009) by restricting the type of activities one is able to safely engage in. In an effort to achieve independence following a stroke, there is a need to screen and assess visual perception (Katz, Itzkovich et al. 1989) as well as cognitive problems as part of a holistic rehabilitation program (Zinn, Dudley et al. 2004).

Screening is a method of distinguishing patients with a particular condition or impairment from those without (Bonita, Beaglehole et al. 2006). Screening patients for cognitive and visual perceptual problems is useful in order to determine patients who need more in-depth assessments to ascertain the extent of their problem and develop a treatment plan accordingly (Rowe, Brand et al.

2009). Since cognitive-perceptual problems can have such a negative impact on independence, it is worth investigating aspects which could potentially improve the identification and thus rehabilitation of patients who suffered stroke and therefore maximise their rehabilitation potential (Jones and Shinton 2006). Screening tools have been documented to be easier, faster and cheaper than definitive assessments (Bonita, Beaglehole et al. 2006), (Braveman and Tarimo 1994), (Strong K, Wald N et al. 2005), in that they identify patients who require lengthy assessments from those who do not, consequently making it more cost efficient for patients. It is further more time efficient for the occupational therapist to quickly identify which patients require more help, particularly when the therapist has a number of patients to manage.

Using an accurate screening tool makes it possible for all patients who have suffered a stroke to be evaluated. This means that patients with cognitive-perceptual problems will not be missed and any problems identified will be managed accordingly. The Occupational Therapy Adult Perceptual Screening Test (OT-APST) (Appendix A) is a screening tool which was developed for the purpose of identifying patients with visual perceptual problems and apraxia following a stroke or other forms of acquired brain injury (Cooke, McKenna et al. 2005), (Cooke, McKenna et al. 2006). The OT-APST was first introduced in 2006, when its normative data was developed, and the validity as well as reliability have been tested by the author of the test, Dr Cooke (Cooke, McKenna et al. 2005). Currently, there are no visual perceptual screening tools being used in South Africa and patients are evaluated using the long assessment batteries such as the Loewenstein Occupational Therapy Cognitive Assessment when resources permit (Jandrell, Engelbrecht et al. 2013). The latest version of the LOTCA is the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (Appendix B). The Rivermead Perceptual Assessment Battery (RPAB) (Appendix C) is another long assessment tool specifically for visual perception which is taught in undergraduate programs in some universities in South Africa.

The OT-APST is currently not being used in South Africa and possible reasons for this include that occupational therapy departments or private practitioners already invested in the often expensive, longer assessment batteries and/or therapists are

not familiar with this ‘new’ tool. Most occupational therapy departments use the LOTCA which is considered the gold standard in terms of visual perceptual tests (Jandrell, Engelbrecht et al. 2013). Although the LOTCA is a gold standard, it requires approximately 60 minutes to complete making it impossible to use as a screening tool. It is lengthy and it should be used in its entirety (Itzkovich, Elazar et al. 1993).

1.2 Problem statement

The majority of the research on the psychometric properties of the OT-APST had been done in Australia by the author, Dr Cooke, who reported that the OT-APST demonstrated criterion, ecological and construct validity (Cooke, McKenna et al. 2006), (Cooke DM, McKenna K et al. 2006a). There were however, some limitations related to these studies related to possible bias as the author administered most of the screening and was not blinded to the results of the previous assessment (Cooke, McKenna et al. 2006). The results on the validity of the OT-APST were further contradicted by Dr Brown (Brown, Mapleston et al. 2011) who found that the OT-APST did not converge where it was theoretically expected to when compared to the Neurobehavioural Cognitive Status Examination (Cognistat) and Developmental Test of Visual Perception- Adolescent and Adult (DTVP-A) (Brown, Mapleston et al. 2011). Considering the potential benefits of a screening tool in terms of time and cost, there was a need to demonstrate and clarify the degree of convergent validity of the OT-APST. This can be a valuable screening tool for therapists in the South African context.

1.3 Research question

Does the OT-APST demonstrate convergent validity with two other commonly used cognitive-perceptual tools in a South African stroke sample?

1.4 Aim

The aim of the study was to determine the convergent validity of the OT-APST with two other cognitive-perceptual tools commonly used in South Africa.

1.5 Objectives

1. Theoretically identify and compare similar construct/items of the OT-APST and the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA)
2. Theoretically identify and compare similar construct/items of the OT-APST and the Rivermead Perceptual Assessment Battery (RPAB)
3. To compare the individual items of the OT-APST with the items of the DLOTCA
4. To compare the individual items of the OT-APST with the items of the RPAB
5. To compare the OT-APST subscales with the DLOTCA cognitive areas
6. To compare the OT-APST subscales with the individual items of the RPAB

1.6 Justification

Occupational therapists need to use screening tools which demonstrate validity and reliability in order to correctly identify patients with cognitive and perceptual impairments (Cooke, McKenna et al. 2006); this will substantiate the need for detailed assessments and guide appropriate intervention (Cooke DM, McKenna K et al. 2006a), (Brown 2010). Using screening tools which have not been validated may have negative consequences (Brown 2010) as these tools may identify patients who actually do not need further assessments (false positive) or it may fail to identify patients who require further assessments (false negative). False positive identification leads to patients having to pay for assessments which are not necessary. If the OT-APST demonstrates convergent validity it can be used to the benefit of the patient in cutting costs for assessments which are lengthy when the patient does not require them. The OT-APST can also be used as a means to justify using longer assessments since the screening tool includes the major components of visual perceptual problems occurring after stroke (Cooke, McKenna et al. 2005). However, the interpretation of results from a tool without validity has little or no significance and is meaningless and the process of testing would be rendered useless (Downing 2003).

CHAPTER 2
LITERATURE REVIEW

INTRODUCTION

This chapter gives a review of research with regards to stroke, cognition and perception as well as a brief review of how other researchers have conducted their research on validity. Articles were obtained by performing a search in the online databases: PubMed and EBSCO as well as using Google Scholar to identify relevant literature. The literature was reviewed under the following subtopics: Stroke, Cognition, Visual Perception, Cognitive-perceptual tools, Validity and Review of Methodology. Under Stroke, consequences of stroke are briefly described and the prevalence of stroke in general and how it relates to cognitive-perceptual problems. The Cognition subtopic describes the effect of stroke on cognitive skills and some of the presenting problems which may be seen secondary to stroke. Visual perception subtopic describes in detail some of the perceptual problems which are often seen after stroke and how they are assessed. The Cognitive-perceptual subtopic briefly describes the instruments used in this research which were compared against the Occupational Therapy Adult Perceptual Screening Test (OT-APST). Validity subtopic briefly introduces the definition of validity and what it implies. Review of methodology subtopic describes in some depth the type of testing which the OT-APST has undergone.

2.1 Stroke

A significant number of patients in hospitals is made up of people who have had a stroke (Katz, Itzkovich et al. 1989). The prevalence of stroke increases with age (Schmidt, Roesler et al. 2004), (Patel, Coshall et al. 2002), but due to medical advancement, more people survive following a stroke and the prevalence of stroke in a study done in rural South Africa was 3 per 1 000 (Connor 2004). Although the survival rate is improving, the patients often have residual deficits which affect their areas of occupation, with 66% of the survivors in Connor's study, requiring help in at least one activity of daily living (ADL). This is high compared to other countries (Connor 2004) which can be due to inadequate screening, lack of assessments or lack of treatment leading to activity limitations in ADLs. A study

by Mudzi recently revealed that it was not sufficient to train caregivers of patients after stroke (Mudzi, Stewart et al. 2012). This supports the need for professional help in order to achieve independence and to improve participation which is described as the desirable outcome following stroke (Hsueh, Jyun-Hong et al. 2013). Patients who had strokes are frequently treated by occupational therapists (Jones and Shinton 2006), (Rubio and Van Deusen 1995) whose main aim is to improve or maintain patients' safe function in areas of occupation and to enable participation (Cooke, McKenna et al. 2005a), (Association 1994), (Marom, Jarus et al. 2006). In order to plan effective treatment programmes, there is a need for comprehensive evaluations in order to determine if the patient has any deficits secondary to stroke.

Stroke can present with cognitive, sensory, perceptual and/or motor deficits (Mercier, Audet et al. 2001) and these deficits often significantly affect an individual's functioning and independence in areas of occupation (Association 2008). The cerebral hemispheres have hemispheric lateralization (specialisation) with the majority of people's left hemisphere being dominant for language and the majority of the people being right-handed (Knecht, Deppe et al. 2000). Regardless of this lateralization, both cerebral hemispheres are required for an individual to have functional visual perception as the two sides contribute to different aspects of perception (Warren 1993). Studies have shown that perceptual dysfunction can occur following either a left or right sided stroke (Paolucci, McKenna et al. 2009), (Rubio and Van Deusen 1995). It is important to note that cognition and perception are two domains which are difficult to separate because there is a gross overlap of cognitive skills required in visual perception as will be discussed in the next sections. Although cognition and perception are split in this review, it is important to note that perception is an executive function and most research looking at cognition almost always includes visual perception as a cognitive skill (Akbari, Ashayeri et al. 2011), (Stephens, Kenny et al. 2005). Visual perception is processed in various parts of the brain such as the posterior parietal lobe which processes spatial relations and the inferior temporal lobe which processes object perception (Schneck 2010), (Warren 1993). It is further well established that cognitive impairments are also common following a stroke especially ischaemic infarcts and these impairments can also negatively affect the functional outcome of

therapy (Tatemichi, Desmond et al. 1994), (Patel, Coshall et al. 2002), (Rabadi, Rabadi et al. 2008), (Zinn, Dudley et al. 2004). The prevalence of cognitive impairments following stroke are varied, some studies have documented it to be 35% to 38% in hospital based (Tatemichi, Desmond et al. 1994), and population based studies (Patel, Coshall et al. 2002) while in a study by Nys et al., they found the prevalence of cognitive impairments in first strokes to be as high as 49% which then decreased to 30,6% after a 10 month period post-stroke (Nys, van Zandvoort et al. 2005).

2.2 Cognition

Cognition is a term which encompasses a number of cognitive areas including memory, orientation, language abilities as well as visuospatial abilities (Cumming, Marshall et al. 2013). Both mild and severe strokes may present with cognitive impairments with the severity of the impairments being determined by a number of factors such as the location, size of lesion and age (Mansueti, de Frias et al. 2008). Patients with silent strokes (small, asymptomatic strokes) have also been noted to have significant cognitive impairments which also affected their self-perceived independence in performing ADLs (Schmidt, Roesler et al. 2004). In a study by Rabadi et al., left cerebral hemisphere stroke presented with more severe cognitive problems (Rabadi, Rabadi et al. 2008), this is consistent with the findings of Patel et al., who found that left strokes, older patients and lower socioeconomic classes were at a higher risk of cognitive impairments following stroke (Patel, Coshall et al. 2002).

Cognitive abilities enable a patient to make appropriate adjustments despite having a physical limitation (Marom, Jarus et al. 2006). Cognitive impairments may negatively impact on an individual's ability to benefit from the therapy and this will invariably affect the functional outcome (Zinn, Dudley et al. 2004), (Akbari, Ashayeri et al. 2011) which lead to activity limitation or participation restriction. Therefore, cognitive impairments are likely to affect the outcome by negatively impacting on the rehabilitation process (Tatemichi, Desmond et al. 1994), (Rabadi, Rabadi et al. 2008), (Zinn, Dudley et al. 2004). In order to improve the recovery of a patient after stroke, there is need to assess the cognitive functions of a patient on admission (Zinn, Dudley et al. 2004), so as to formulate feasible aims

and goals for therapy (Parker, Bugdayo et al. 2010), (Patel, Coshall et al. 2002), (Akbari, Ashayeri et al. 2011). Cognition plays a major role in visual perception (Pylyshyn 1999) with a number of cognitive tests including an element of perception especially visuospatial abilities (Tatemichi, Desmond et al. 1994) which include constructs such as body scheme and spatial relations.

2.3 Visual perception

As previously mentioned, perception is intricately linked to cognition. To complicate the matter of separating perception from cognition is the fact that perception is strongly influenced by attention which is a cognitive skill, especially selective attention which is an active process (Greene 2005). Perception has been defined as the process of incorporating and organizing information received from the environment via sensory impulses, and the process involves changing the sensory input into a mental representation of the meaning (Wilson 1999). Visual perception is the dynamic process by which the brain interprets sensory impulses received from visual stimuli (Wilson 1999), (Phipps 2006). The way in which the brain interprets visual information is greatly influenced by cognitive processes (Pylyshyn 1999) such as memory which determines how we assign meaning to what we see (Wallach 1949). As previously mentioned, cognition and perception are intricately linked with some constructs of perception being included under both perception as well as cognition such as neglect, agnosia (object recognition) and visuospatial abilities (Cumming, Marshall et al. 2013), (Nys, van Zandvoort et al. 2005). Functional perception of the environment provides adequate information to which appropriate behaviour or actions are carried out therefore, perceptual dysfunctions will present as an individual's inability to perform certain activities (Rubio and Van Deusen 1995), (Phipps 2006) e.g. picking a jar from a shelf whilst shopping. Perceptual deficits will not be confined to affecting one aspect of an individual, but impact on all aspects i.e. self-care, work and leisure (Paolucci, McKenna et al. 2009). Deficits can also pose serious safety concerns (Paolucci, McKenna et al. 2009), (Phipps 2006). Perceptual dysfunction is of importance to the occupational therapist because of the impact it has on function, independence and safety (Cooke, McKenna et al. 2005).

Following stroke, perceptual deficits need to be evaluated to ascertain the degree of severity of the problems (Mercier, Audet et al. 2001), and how they affect independence; this is particularly important for therapists to formulate effective treatment plans (Titus, Gall et al. 1991). Recent studies have shown that specific perceptual deficits appear to be influenced by the side of the stroke (Paolucci, McKenna et al. 2009). Paolucci, et al. found that body scheme was significantly impaired in patients with left hemisphere stroke while unilateral neglect and constructional skills were more impaired in patients with right hemisphere stroke (Paolucci, McKenna et al. 2009). Visual perception is composed of different components which may be split into visual cognitive skills and visual receptive skills (Warren 1993).

2.3.1 Components of visual cognitive perception

Visual perception may be viewed as a hierarchy of skills with complexity increasing and more sophisticated skills are built on the integration of lower and more basics skills (Warren 1993). At the bottom of the pyramid are the visual receptive skills which include oculomotor control, visual acuity and visual fields; these skills form the foundation for the more complex visual-cognitive functions (Warren 1993), (Schneck 2010). Visual perceptual problems are a result of poor perception but with an intact primary sense and are therefore not a result of faulty receptors (Beery and Beery 2010). Visual attention and scanning are the intermediate skills which are developed from the three basic skills mentioned above (Warren 1993). Visual inattention, which may also be referred to as unilateral neglect or hemi-neglect or visual neglect (Unsworth 2010), presents with asymmetrical visual scanning (Phipps 2006). In a study by Rowe, et al, the majority of patients (n= 323) presenting with perceptual deficits had visual neglect (Rowe, Brand et al. 2009). Visual neglect is differentiated from visual field defects by the use of cancellation tasks which are often used in evaluations (Jones and Shinton 2006).

On the hierarchy by Warren (1993), high level skills include pattern recognition which involves taking note of an objects gross features, visual memory is being able to recall a visual image, and visual cognition is the most evolved skill in perception which has been defined as “the ability to mentally manipulate visual

information and integrate it with other sensory information to solve problems, formulate plans, and make decisions" page 43: (Warren 1993). Deficits in visual cognition give rise to problems such as in figure-ground, agnosia, spatial relations and visual closure (Warren 1993).

Although the OT-APST has a total of seven subscales, the literature will be reviewed under six of the seven subscales presented in the OT-APST; Agnosia, Body Scheme, Unilateral Neglect (Body Scheme and Unilateral Neglect fall under a broad heading of Visuospatial Relations); Constructional Skills, Praxis and Acalculia (Cooke, McKenna et al. 2005). Although the OT-APST includes a 7th Functional skills subscale, this will not be included as neither the DLOTCA nor the RPAB have any functional items. This subscale includes items such as Reading, Writing, Calculations, Telling the Time, and Stapler Hold and Use to Command items. All the items under the Functional skills subscale have been reviewed in other sections, e.g. Reading item falls under Agnosia as well as Unilateral Neglect (Cooke 2005).

2.3.2 Agnosia

Visual agnosia is an inability to identify presented shapes or objects in light of intact visual receptive skill (Huberle, Rupek et al. 2012), (Riddoch and Humphreys 1987). Agnosia can be specific to for example faces, colours or words and it occurs with visual stimuli which would ordinarily stimulate semantic knowledge (Shelton, Bower et al. 1994), (Greene 2005). Greene (2005) presented the following ways in which visual agnosia may be identified:

- Asking a patient the name of a presented object
- Describing what is seen
- Miming a presented object's use
- Identifying overlapping line drawings
- Identifying incomplete images (Greene 2005).

A number of visual perceptual constructs fall under agnosia subscale including: constancy and figure-ground.

2.3.2.1 Constancy

Constancy refers to how an object or colour remains unchanged regardless of environmental changes, orientation, angle or lighting (Smithson 2005), (Humphreys and Riddoch 1984). Constancy provides stability to the visually-enriched environment around us (Foster 2003). There are different types of constancy such as shape constancy and colour constancy. Colour constancy is important for the functional use of colour vision. The visual system is challenged by the effects of illumination on colour as it has to deuce the actual colour despite the illumination e.g. a green leaf under yellow lighting (Foster 2003). The same applies for objects in general. Objects are easily recognized according to their orientation to gravity and recognising the unique features of the object also contributes to object constancy despite changes in orientation, presentation, angle or lighting (Humphreys and Riddoch 1984). Asking the patient to name a colour is a documented and recognised way of directly determining colour constancy (Smithson 2005), (Foster 2003) but colour naming has also been associated with aphasia and alexia therefore deficits in colour naming may be due to either poor colour constancy or colour anomia (Ruttiger, Braun et al. 1999). In agnosia (colour or object constancy), however, the inability to name is a result of the patient not being able to recognise the colour or object making naming impossible (Riddoch and Humphreys 1987).

2.3.2.2 Figure-ground

Figure-ground is the ability to separate the foreground from the background, and focusing on the important stimuli within a distracting background (Schneck 2010). In segregating the figure from the background, there is border-ownership assignment which has been documented to be the first step in figure-ground perception (Craft, Schutze et al. 2007). This may be demonstrated in the face-vase illusion; how one perceives the image is dependent on border assignment (Pitts, Martinez et al. 2011).

While there are a number of factors determining the identification of a figure from the background, there is evidence which shows that past experience is also a factor contributing to figure-ground perception (Trujillo, Allen et al. 2010). Figure-ground assessment items often have images imbedded or overlapping figures

(Cooke 2005), (Itzkovich, Elazar et al. 1993), (Whiting, Lincoln et al. 1985). Functionally, figure-ground allows one to be able to read by focusing on a particular line within a competing background of other words (Schneck 2010). It has been reported that a stroke patient can achieve his/her pre-stroke figure-ground skills with intensive rehabilitation (Shah, Holmes et al. 2007).

2.3.3 Reading

As previously mentioned in the above section, figure-ground perception is required for one to have functional reading (Schneck 2010). The OT-APST included the Reading item under Agnosia as well as functional skills and since this research compared items under Agnosia, Reading item was also included in relation to Agnosia. One's reading abilities may be negatively affected by stroke (Eames, McKenna et al. 2003). A number of visual perceptual skills have a negative impact on reading. These include skills such as spatial relations and unilateral neglect which will be described below.

2.3.4 Visuospatial Relations

Spatial relation is the ability to perceive the relationship between objects or between an object and self (Akbari, Ashayeri et al. 2011). Patients with poor spatial relation skills have been noted to perform poorly in basic ADLs following a stroke (Stephens, Kenny et al. 2005) therefore, spatial relations have an impact on the degree of independence (Akbari, Ashayeri et al. 2011). Poor spatial skills negatively affect a patient's performance in ADLs (Warren 1981), e.g. if a patient is not able to perceive the relationship between self and surrounding objects, they could end up harming themselves by bumping into objects or tripping over objects in the environment. Without spatial relations, it can be risky to let such a patient attempt cooking without supervision amongst other things. In the OT-APST, Body Scheme and Unilateral Neglect fall under Visuospatial Relations (Cooke 2005).

2.3.4.1 Body scheme

Body scheme is a product of maturation and it is the neural component to body awareness which is knowing where one's body is (O'Bien and Williams 2010). This skill allows one to make accurate judgements regarding one's body in relation to space (spatial relation) and motion. Problems with body scheme have been acknowledged to negatively impact on an individual's ability to safely engage in

ADLs (Warren 1981). For example patients may have problems manoeuvring in their environment because they are not able to appreciate where their body parts are. A number of sensory systems feed into the body scheme such as the proprioceptive, tactile and vestibular systems (O'Bien and Williams 2010). Body scheme is often assessed by asking the patient to touch a specified object/body part or to describe the relationship between self and surrounding objects (Cooke 2005), (Katz, Livni et al. 2011).

2.3.4.2 Unilateral neglect

Unilateral neglect is when a patient is unable to attend to a side of his body, opposite the side of the stroke in the brain and is often due to, but not limited to damage to the parietal lobe and the right insular lobe (Manes, Paradiso et al. 1999). Unilateral neglect is most common in right hemisphere strokes and often a result of poor attention and spatial skills which are considered to be processed in the right hemisphere (Pomeroy 2006). Unilateral neglect following a left hemisphere stroke is uncommon as the right side of the brain attends to both sides of the body (Pomeroy 2006), (Greene 2005). Unilateral neglect is assessed by giving a patient a task which require he pay attention to both the left and right side of his body or visual field (Cooke 2005), (Whiting, Lincoln et al. 1985). Unilateral neglect invariably reduces the functional status of a patient especially when it is also associated with anosognosia (which is when the patient is unaware of their problem) (Pomeroy 2006). Unilateral neglect can pose a risk in activities such as community mobility when a patient is unable to attend to his/her affected/neglected side.

2.3.5 Praxis

Apraxia is the inability to perform learnt/skilled movements in the absence of ataxia, motor or sensory impairments (Kaya, Unsal-Delialioglu et al. 2006) and it is usually due to parietal lobe damage **(**Caminiti, Chafee et al. 2010). Praxis includes motor planning and execution of motor activity while inhibiting unwanted movements (Wheaton, Fridman et al. 2009). The most documented types of apraxia are ideational apraxia and ideomotor apraxia (Kaya, Unsal-Delialioglu et al. 2006), (Wheaton, Fridman et al. 2009), (Goldenberg and Spatt 2009), (Butler 2002). Praxis is usually evaluated by asking the patient to imitate actions, perform

actions on verbal commands, pretend to use objects or giving them actual objects to use (Butler 2002). Cermak et al, documented how imitation is easier than executing an action on verbal command (Cermak, Morris et al. 1990). Most tests start with verbal commands and only if the patient fails to execute the correct action, the therapist will move on to demonstrating the action which the patient then has to copy/imitate(Cermak, Morris et al. 1990). Not being able to inhibit an inappropriate action as seen in perseveration (unwilling/unaware repetition of invalid movements) is also included in praxis and may be observed in patients with ideomotor apraxia (Wheaton, Fridman et al. 2009). In assessing praxis, a patient who is unable to use a tool, whether a familiar tool or an unfamiliar tool, is defined as having ideational apraxia. The patient cannot come up with an idea of how to use the given tool (Goldenberg and Spatt 2009). Ideational apraxia may also be assessed by asking the patient to complete a task with multiple action sequences e.g. putting a letter in an envelope (Butler 2002). Ideomotor apraxia is seen when a patient is not able to perform an action when verbally requested e.g. to touch his nose, but the patient is able to do the action spontaneously without verbal commands (Kaya, Unsal-Delialioglu et al. 2006) or they may not be able to imitate an action (Caminiti, Chafee et al. 2010). Butler found that there was a poor relationship between Ideomotor Apraxia test, Mimed use of objects, Ideational Apraxia scoring sheet and Ideomotor apraxia tests assessing apraxia and he attributed this to possibility that the various tests assess different aspects of apraxia (Butler 2002). Another form of apraxia is constructional apraxia (Caminiti, Chafee et al. 2010) which is explained under Constructional skills.

2.3.6 Constructional skills

According to Caminiti et.al “the inability to copy a visual model, either by drawing or by physical assembly is central to the definition of constructional apraxia” page 2327: (Caminiti, Chafee et al. 2010). Constructional apraxia is a perceptual motor impairment which entails deficits in drawing, copying and building 3D structures (Baum and Hall 1981). Some authors have suggested grouping the skills into graphic, two-dimensional and three-dimensional skills and testing it in the same way by using graphic, two-dimensional or three-dimensional tasks (Baum and Hall 1981), (Russell, Deidda et al. 2010). Although graphic tasks are used to evaluate constructional praxis, it is important to highlight how these tasks are also

influenced by fine motor skills for example, drawing shapes is a graphic skill but if the patient has poor pencil grasp and poor motor control, they will fail to draw the shapes although they know how to draw. Constructional tasks also measure one's spatial abilities (Murray, Cermak et al. 1990) because one has to know the relationship between his/her body parts. What separates constructional apraxia from the previously mentioned types of apraxia is that constructional apraxia involves reproducing a drawing or structure provided visually whilst ideomotor and ideational apraxia are concerned with only a motor action (Caminiti, Chafee et al. 2010). Constructional apraxia may occur due to either a left or right sided stroke with a differing clinical presentation depending on the affected hemisphere. It is however, often due to damage to the right parietal lobe with the patient not being able to appreciate the spatial relationship/orientation of elements/objects (Baum and Hall 1981), (Russell, Deidda et al. 2010). Patients with poor constructional apraxia have been noted to have poor with functional abilities such as dressing (Baum and Hall 1981).

2.3.7 Acalculia

Acalculia has been defined as an impairment or loss of previously acquired arithmetic skills (Bernal, Ardila et al. 2003). It has been reported to occur when a patient had a left hemisphere stroke and is often linked to language problems (Bernal, Ardila et al. 2003). In the reported cases of left hemisphere stroke and acalculia the patients were right handed and some authors have implied that acalculia occurs in the dominant hemisphere (Bernal, Ardila et al. 2003), (Zukic, Mrkonjic et al. 2012). Patients with acalculia have been described has having difficulties using numerical information and solving addition and subtraction problems (Bernal, Ardila et al. 2003).

2.4 Cognitive-perceptual tools

Component assessments are often used to determine a patient's skills and impairments, and these focus on how the body is functioning (Marom, Jarus et al. 2006) and are useful in identifying impairments such as physical or cognitive-perceptual impairment. In a study done by Jandrell et al, they found that the main cognitive perceptual tool currently being used frequently in South Africa is the LOTCA (Jandrell, Engelbrecht et al. 2013). The DLOTCA is the latest version of

the LOTCA which is considered a gold standard in visual perception in adults. The RPAB is another visual perception tool which is also taught in the undergraduate programs in South Africa. The assessment tools used in this research are commonly used assessments in South Africa as well as readily available.

2.4.1 Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)

The initial LOTCA was developed in Israel at Loewenstein Rehabilitation Hospital (Katz, Itzkovich et al. 1989). The main purpose was to assess the cognitive abilities of patients following head injuries (Katz, Itzkovich et al. 1989). The LOTCA has 26 items grouped into six cognitive subscales including: orientation, visual perception, spatial perception, visuomotor organisations, motor praxis and thinking operations (Itzkovich, Elazar et al. 2000). The Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) (Katz, Livni et al. 2011) is the latest version of the LOTCA (Appendix B). The DLOTCA was developed to determine the level of functioning for a patient in the different cognitive areas as well as to determine the potential of the patient to learn (Katz, Livni et al. 2011). This information is useful in the planning of the occupational therapy treatment (Itzkovich, Elazar et al. 2000). The previous LOTCA was considered the gold standard (Cooke, McKenna et al. 2006) and the DLOTCA is the improved version of the LOTCA. The major difference between the LOTCA and the DLOTCA is the mediation aspect, where if a patient gets an item wrong, the patient is cued (there are four to five levels of cueing for each item; refer to Appendix B) and then they are scored according to how much mediation was required (Katz, Livni et al. 2011). The mediation cues are based on Toglia's guidelines (Katz, Livni et al. 2011) who suggested that dynamic assessments elude to how much the patient is able to learn, what the authors referred to as 'zone of rehabilitation potential' (Toglia and Cermark 2009). The amount of mediation will determine the length of administration, it may take one or two hours and it may be done in two sessions (Katz, Livni et al. 2011). The other difference between the LOTCA and the DLOTCA, apart from the obvious mediation aspect, are a few name changes of items such as LOTCA Overlapping Figures is now Figure-Ground in the DLOTCA. Some items such as the LOTCA Visual Identification of Shapes were removed in the DLOTCA. The validity of the LOTCA

has already been established. The DLOTCA demonstrated good interrater reliability with high correlations (r= 0,98) and discriminant validity was done between stroke patients and normal adults for the DLOTCA (Katz, Livni et al. 2011).

Dynamic assessments are based on identifying the zone of proximal development and the DLOTCA has mediation and cueing included within the evaluation process to determine the potential of the patient to learn (Katz, Livni et al. 2011). This tool was used on the assumption that the previous LOTCA was considered a gold standard therefore the improved LOTCA, DLOTCA, would be better. However, there is no research to support whether the new DLOTCA is a gold standard replacing the previous one.

As mentioned before, visual perception and cognition are difficult to separate and in both the LOTCA and the DLOTCA, visual perception is considered a primary cognitive area (Katz, Livni et al. 2011). The results are not compared with a normative sample and results from a dynamic tool are considered to be more ecologically valuable as compared to static tools since it gives an indication of the patients ability to learn (Katz, Erez et al. 2012). The DLOTCA which was used in this study has 28 items grouped under seven cognitive areas which include Orientation, Awareness, Visual Perception, Spatial Perception, Praxis, Visuomotor Construction and the Thinking Operations. Of the seven cognitive areas, Orientation and Awareness are not dynamic; there is no cueing or mediation if the patient gets the item wrong.

2.4.2 Rivermead Perceptual Assessment Battery

The Rivermead Perceptual Assessment Battery (RPAB) was developed to assess visual perception in patients following a stroke and it may also be used to monitor progress (Whiting, Lincoln et al. 1985). It has a total of 16 items grouped into eight categories: Form Constancy, Colour Constancy, Sequencing, Object Completion, Figure-Ground Discrimination, Body Image, Inattention and Spatial Awareness (Whiting, Lincoln et al. 1985). The tool takes about 45 to 60 minutes to administer on healthy subjects, and can be administered in two sessions (Whiting, Lincoln et al. 1985). Results from the RPAB are compared to normative data. RPAB has demonstrated test- retest reliability with 11 out of 16 subscales having a

correlation above 0,5 (Whiting, Lincoln et al. 1985). For validity, the performance of patients on the RPAB was compared to their performance on Wechsler Adult Intelligence Scale (WAIS) , Wechsler Logical Memory and Warrington Non-verbal Recognition which are psychological tests (Whiting, Lincoln et al. 1985).

Both the DLOTCA and RPAB are lengthy and require at least 45 minutes to complete and makes them both too long to be used by occupational therapists as screening tools. It is not practical to use such tools with every stroke patient, thus a need for a screening tool.

2.4.3 Screening

Screening is useful in identifying patients who are at risk of having an impairment and who will benefit from in-depth assessments (Strong K, Wald N et al. 2005). Screening saves time as it is easier, faster and cheaper than full cognitive or perceptual assessments (Braveman and Tarimo 1994). A screening tool is not a diagnostic test but the outcome from a screening tool may indicate the need for further assessments, follow-up and/or treatment (Strong K, Wald N et al. 2005). Screening tools need to have specificity and sensitivity, i.e., be able to correctly identify patients who do not require further tests (specificity), from those patients with deficits (sensitivity) (Blake, Mckinney et al. 2002).

The OT-APST is an occupational therapy screening instrument which was developed for use with adult patients following stroke or other forms of acquired brain injuries (Cooke, McKenna et al. 2005; Cooke, McKenna et al. 2006). The tool was developed in response to a need for a comprehensive visual perception screening tool, since available instruments in occupational therapy were too lengthy and these tools were designed to be administered in their entirety for validity reasons (Cooke, McKenna et al. 2005).

The OT-APST has a total of 25 items which have been grouped into seven subscales or categories of: Agnosia, Body Scheme, Unilateral Neglect, Constructional Skills, Praxis, Acalculia and Functional skills (refer to Appendix A) (Cooke, McKenna et al. 2005). Some of the items fit in more than one subscales as shown in Appendix A, e.g. the Clock items fits in both Unilateral Neglect as well as Constructional skills. The tool can be administered in approximately 20-25

minutes and it should also be completed in its entirety to maintain its validity properties (Cooke, McKenna et al. 2005).

2.4.3.1 Previous research done on the OT-APST

In a study by Cooke et.al., to determine the construct and ecological validity of OT-APST, results were compared and correlated with the LOTCA and the LOTCA-G (Geriatric) which were used as a "gold standard" (Cooke DM, McKenna K et al. 2006a). Construct validity for the OT-APST was determined by convergent validity as well as discriminant validity (Cooke DM, McKenna K et al. 2006a). Cooke found that the LOTCA had several subscales which could be compared to the OT-APST and Spearman's rho correlations were used to determine convergent validity between these items (Cooke DM, McKenna K et al. 2006a). This showed statistically significant correlations with $p < 0,01$; and discriminant analysis with an eigenvalue of 0,506, indicated that the screening tool accurately separated the healthy sample from the patients who had suffered a stroke for discriminant validity (Cooke DM, McKenna K et al. 2006a). Ecological validity was determined by comparing results from the OT-APST and the Modified Barthel Index, indicating statistically significant correlations, $p<0,01$ and the Cronbach's α ranged between 0,71 to 0,83 indicating good internal consistency (Cooke DM, McKenna K et al. 2006a). In the same research on the OT-APST and LOTCA/LOTCA-G by Cooke et.al, they did not compare OT-APST Acalculia and Functional skills subscales to the LOTCA because the LOTCA did not have an item evaluating arithmetic skills or functional skills (Cooke DM, McKenna K et al. 2006a). Although the LOTCA does not have a subscale specifically for Unilateral neglect, the authors in the same research added the LOTCA Puzzle and Clock items to have a subscale comparable with the OT-APST Unilateral Neglect subscale (Cooke DM, McKenna K et al. 2006a). They also found the highest correlations to be with the Constructional Skills (rho= 0,802) and Unilateral Neglect subscales (rho= 640) (Cooke DM, McKenna K et al. 2006a).

In a study done by Dr Brown et al. to ascertain the convergent validity of the OT-APST he compared the scores from two other cognitive-perceptual tests to those of the instrument under investigation (Brown, Mapleston et al. 2011). The patients needed to have sufficient endurance to complete all three tools. The researcher

used the Neurobehavioural Cognitive Status Examination (Cognistat) and Developmental Test of Visual Perception- Adolescent and Adult (DTVP-A). While the DTVP-A is a test specifically for visual perception, the Cognistat is a cognitive screening test and it has a few subscales which address visual perception from the description given in the research by Dr Brown et al. (Brown, Mapleston et al. 2011). In his study, Brown used thirty-two adult patients who were screened within a week of admission into a rehabilitation unit after a stroke with all three tools being administered on the same day (Brown, Mapleston et al. 2011). The researchers used Spearman's rho between subscales of the OT-APST and the reference tools (although in comparison, the DTVP-A does not really have subscales) and the raw scores from all three tools were used to calculate the correlations. The OT-APST did not correlate, for the most part, where it would have been expected to correlate with the Cognistat with only three out of the ten subscales significantly correlating (Brown, Mapleston et al. 2011) this might be attributed to the fact that the Cognistat is essentially a cognitive screening tool. It must be noted that the level of significance was set from 0,4 when rounded up despite having a small sample of 32 and the significant correlations between the Cognistat and the OT-APST were ranging from 0,357 to 0,381 $p<0,05$ (Brown, Mapleston et al. 2011). The Cognistat Constructional ability and Calculation significantly correlated with the OT-APST Body Scheme while the other Cognistat Memory subscale significantly correlated with the OT-APST Functional skills subscales. The DTVP-A Figure-Ground, Visual motor Search and the Visual closure all significantly correlated with the OT-APST Body Scheme subscale with the correlations ranging from 0,372 to 0,422 $p<0,05$. These results reveal that only one subscale from the OT-APST significantly correlated with half of the DTVP-A subscales (Brown, Mapleston et al. 2011). This raises the question of whether results from the OT-APST are significant.

2.5 Validity

Validity is described as the appropriateness of a test and indicates whether it tests what it purports to test (American Educational Research Association 1996). Validity confirms or refutes the interpretation of results from a test, and it is not an all or nothing measure but rather a matter of extent (Downing 2003), (Brown

2010). Interpreting scores from tools or instruments without sufficient validity testing are not very useful (Downing 2003).

A convergent validity study focuses on evaluating similarity or correlation of test results with other similar tests, that is, the test results would be expected to be theoretically alike (Brown 2010). The Standards for Educational and Psychological testing identifies five sources of validity which are: relationship to other variables, content, internal structure, responses and consequences (American Educational Research Association 1996). Convergent validity is considered under *relationship to other variables*. This source of validity is correlational or statistical where a more recently developed measure is validated against an older measure with demonstrated characteristics (Downing 2003).

2.6 Conclusion

The information from the literature review provided a guide on how to group and compare like-constructs in the results chapter as well as guide in the discussion chapter as well. Review of methodology was used to formulate the procedure of the research and this is discussed in detail in the next chapter on methodology.

CHAPTER 3
METHODOLOGY

INTRODUCTION

This chapter describes in the detail the procedure and guiding principles of choosing the patients as well as the ethical clearance and permission sought before conducting the research. This study was carried out by comparing the results from the Occupational Therapy Adult Perceptual Screening Test (OT-APST) with results from Dynamic Loewenstein Occupational therapy Cognitive Assessment (DLOTCA) and the Rivermead Perceptual Assessment Battery (RPAB) which are assessment batteries. Previous research done on the Occupational therapy Adult Perceptual Screening test (OT-APST), the author used the LOTCA and LOTCA-G as a gold standard (Cooke DM, McKenna K et al. 2006a). The DLOTCA is the new and improved version of the LOTCA and it was used because it was assumed to be a better version of the LOTCA. The LOTCA is commonly taught in the undergraduate programs across South Africa and is found in most rehabilitation practices. The RPAB is a perceptual assessment which was chosen based on the amount of research the instrument has had.

3.1 Study design

This was a quantitative cross-sectional study that was mainly correlative and comparative in nature. Most research on convergent validity use Spearman's correlation, as such, this research followed suit. The aim was to ascertain whether the three tests when administered at the same time would yield the same result, hence the need of a cross-sectional design. We wanted to establish the convergent validity of the OT-APST.

3.2 Subjects

3.2.1 Sampling

Sampling of convenience was used, patients presenting with diagnosis of stroke at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), Life Kensington Hospital and Netcare Rehabilitation Hospital were included given they met the inclusion criteria. The study had been proposed to start from the 1st of November

2012 to 31st March 2013; however, this time plan was insufficient to get enough patients who satisfied the set criteria of this research. As such, it had to be adjusted until the minimum number of patients (32) was met. Although approval from Chris Hani Baragwanath Academic Hospital (CHBAH) was sought, the researcher was not able to collect data there because the high turnover of patients and the acute nature of their condition, these patients were often not medically stable enough to participate in the research. Unfortunately, the majority of patients admitted at CHBAH also did not understand English, this was prohibitive for data collection as both the consent forms and the tests were in English. The option of translating the tools into native languages and then validation before commencing the actual intended research was not possible because of time constraints. This reduced the generalizability of the findings because there is a group of people which were not included in the study. Time constraints and resources did not give me the luxury of using any other language than English.

3.2.2 Sample size

The sample size included the stroke patients admitted during the above mentioned period was 32 similar to the sample size in Brown et al.'s study (Brown, Mapleston et al. 2011).

3.2.3 Inclusion criteria

The administration criteria of the OT-APST were followed because it was the tool under observation and hence, in order to maintain the type of patient the tool was designed for, it was necessary to adhere to the inclusion criteria defined by the OT-APST (Cooke, McKenna et al. 2006), (Cooke DM, McKenna K et al. 2006a). The inclusion criteria included:

- Primary diagnosis of stroke
- In-patients below 70 years were included because the DLOTCA was designed for a population below 70 years. The OT-APST has cut off scores for people up to 97 years.
- Sufficient endurance and mental acuity to finish all the tools (although the tests were not all administered in one sitting the patient was required to sit for at least 30min)

- Sufficient English to understand and give informed consent as well as understand the instructions of the tools.
- Patients able to sit and attend to table-top activities.
- Patients with functional reading abilities and able to use one hand for task completion independent of hand dominance as specified by OT-APST.

3.2.4 Exclusion criteria

According to the criteria of OT-APST (Cooke, McKenna et al. 2006), (Cooke DM, McKenna K et al. 2006a), patients with the following were excluded:

- Level of consciousness that prohibits completion of the assessment.
- Auditory/receptive language comprehension problems that would reduce the validity of assessment.
- Co-morbid diagnosis or pre-existing diagnosis (e.g. psychosis or dementia) which would interfere with basic cognitive functioning.
- Neurological or psychological event that occurred before the completion of the tools.

3.3 Measurement Instruments

The instruments used were the OT-APST, DLOTCA and the RPAB. The tools which were used to validate the OT-APST are standardised perceptual assessment tools. All the tools have manuals which provide directions on scoring and administration of the tools. While the DLOTCA is a dynamic assessment, the score after mediation was not used because the other two tools i.e. the OT-APST and the RPAB give static measures of cognitive-perceptual skills. Therefore for the scope of this research, the scores after mediation were not used to ascertain the degree of validity.

The OT-APST is currently being used in Australia and has demonstrated criterion, ecological and construct validity (Cooke, McKenna et al. 2006), (Cooke DM, McKenna K et al. 2006a). The tool also has good inter-rater, intra-rater as well as test-retest reliability (Cooke, McKenna et al. 2005a).

The OT-APST has a total of 25 items under seven subscales with several of the items contributing to more than one subscale. The subscale areas include: agnosia, visuospatial relations including body scheme and unilateral neglect,

constructional skill, apraxia, acalculia and functional skills (Cooke, McKenna et al. 2005). It takes approximately 20 to 25 minutes to administer, and it should be administered in its entirety to maintain its psychometric properties. It requires simple verbal or motor responses, which are independent of hand dominance, using one hand for manipulation or writing (Cooke, McKenna et al. 2005). Interpretation of results requires comparing the scores to normative data given and the results will indicate whether there is need for more detailed assessments as well as to guide treatment planning (Cooke, McKenna et al. 2005). The comparison will determine intact or impaired performance. There is a need to assess the impact of the perceptual problems on functional performance for patients with results indicating impairment (Cooke, McKenna et al. 2005). The results from the tool are scored after comparing with normative data and for each item are categorised into either impaired or intact (Cooke, McKenna et al. 2006).

See Appendix D for the comparison of OT-APST and reference tool items, the items chosen were drawn from the OT-APST, therefore items or tests not included in the OT-APST were not included.

3.4 Procedure

Initially the researcher requested notification by the OT staff and nursing staff of any new admission(s) so that the researcher would come evaluate patients a week to check for any new patients admitted. However, this turned out to be impossible as the hospital staff, at all the hospitals, were busy so the researcher went to each hospital every three days and got a list of patient names from the therapists, after the therapists had been informed of the inclusion criteria as well as exclusion criteria.

Problems encountered:

- Few in patients meeting inclusion criteria
- Researcher had to move out of the country
- Research assistants were not consistent
- Patients had to keep to their daily therapy routine and research had to be conducted outside of therapy time.

Although the initial data collection was to be a continuous process, this did not go as planned; the researcher had to move back to her home country. While most data (21 participants) was collected in November, the target number of 32 patients was not reached. For the month of November, the researcher and the assistant went to the three hospitals daily to complete the data collection already started. The patients were evaluated faster than the rate of new admissions such that after 3 weeks there were no new patients as those who met the inclusion criteria had already been evaluated. In order to reduce costs as the researcher's primary residence was outside South Africa, the research was completed at the same as time with lecture blocks. Even though the researcher had lectures in January, no data collection was carried out due to the inability to get an assistant after that block. Data collection was resumed for a week after a one week block of lectures in March; unfortunately the assistant could only collect data at Netcare hence the participants thereafter were from Netcare. As a requirement with the course work portion of the master's degree program, the researcher had to do clinical work after two weeks of being in South Africa and had to postpone the data collection.

The last and final group of data from participants were collected in April. Another reason why the research was not completed at once was that the patients would be admitted for at least two weeks and once the researcher had collected data from the admitted patients, there was a period of inactivity when the researcher would have to wait for new patients. The number of hospitals was also reduced because the patients from CHBAH could not be included on the basis of not being medically stable because it is an acute setting and the patients are discharged once they are stable as well as language barriers. Patients at CHBAH cannot afford to be admitted than is absolutely necessary. Generally, patients from the rehabilitation hospitals (Netcare and Life Kensington) were better suited because they were medically stable enough and they also had endurance which got better once the patient was no longer in the acute state.

In-patients, who met the inclusion criteria, were approached at the hospitals and the research was explained using the standard information sheet. Those who were willing to participate were asked to sign the consent form (Appendix E).

The tests were carried out in at least two sittings, either in the patient's cubicle with the patient sitting upright on a chair or wheelchair or in some cases in a quiet room with minimal distractions. All the participating hospitals gave the researcher a quiet room to use. In order to save on time in moving the participant from their room to the allocated room, the researcher would occasionally opt to use the patient's room. Occasionally the porters were not there to help with getting the patient down from the ward like in the government hospitals and sometimes the research rooms were being used by the therapists or other staff.

In order to reduce bias, the researcher tested the patients using the DLOTCA and the RPAB while an assistant was acquired to conduct the third test (OT-APST). The first assistants were fourth year students in occupational therapy who had just finished their final exams and were about to graduate. In November, the two assistants alternated with the data collection. However, in 2013 the students had graduated and were deployed outside of Johannesburg and being new at their jobs, they could not help with the data collection. The third assistant was a post graduate student at the University of Witwatersrand. Unfortunately, it was not possible to use one assistant for the entire data collection because of availability and financial constraints as well as the already mentioned problems. The assistant(s) and researcher did not communicate on a participant's performance until all the tests had been administered. The three tools were administered on each participant within a time period no greater than 72 hours (replicating the conditions of the criterion validity of OT-APST) (Cooke, McKenna et al. 2006). Although the initial plan was to ensure that care was to be taken to replicate the previous day's activities, e.g. if the patient starts with occupational therapy the same routine would be followed. This was not feasible because the research was not to interfere with the hospital routine. In some instances, the patient was scheduled for MRI or other out of hospital procedures and this was beyond the control of the researcher. The researcher and assistants followed the testing procedure in the manuals for each of the tools.

The patients were screened for visual acuity, visual tracking and visual fields as required by the OT-APST (Cooke, McKenna et al. 2005). If a participant had visual field impairment such as homonymous hemianopia then the administration

of the OT-APST was changed accordingly with the researcher moving all the tool materials into the participant's intact visual field (Cooke, McKenna et al. 2005).

As stipulated in the manual for the RPAB, the researcher was adjacent to the participant's unaffected side. This tool was administered in two sessions (Donnelly 2002). As described in the manual for the RPAB (Whiting, Lincoln et al. 1985), all the activities for the RPAB were performed on the layout guide in order to provide a neutral background and this was placed on a table in front of the patient.

Administration sequence of the three tools was randomised to reduce the test-order effect (Brown, Mapleston et al. 2011). Data from the tools was recorded in tables using Microsoft excel as it is collected. The assistants did not need to go through reliability training since the tool had demonstrated interrater reliability. The order of the test administration was randomised and we did not follow a particular order of administration.

3.5 Data Analysis

Data was coded and stored as well as tabulated using Microsoft Excel. Data was analysed using STATISTICA version 12. Descriptive statistics were used to describe the participants' demographic data. The data was ordinal and there could be no assumption of a normal distribution of stroke. Therefore, non-parametric statistics were used for analysis. Some areas of the three tools assessed theoretically similar aspects and were expected to correlate, however, some aspects which were assessed were different from the other tools (Appendix D). The researcher focused on the theoretically similar aspects of the tools. Areas/subscales of the OT-APST which were not included in the references tools were excluded from the data analysis and are not discussed in subsequent sections. Some items evaluated similar constructs but had different names so the items were grouped according to similarity and not limited to the names in each tool.

Spearman's rank correlation coefficient was used to correlate the data obtained from the tools. The raw scores were used in the correlations and only correlations from 0,6 when rounded up were included in the result chapter because of the

small sample size. The OT-APST groups items into subscales and some items fit into more than one subscale as previously mentioned. The overall performance on each subscale was compared with complementary items in the reference tools or with the similar cognitive areas in the DLOTCA. The DLOTCA had both a 'Before Mediation' score and 'After Mediation' score and using the raw scores of both DLOTCA scores, the data correlated with the OT-APST raw scores as well. The RPAB grouped items but did not sum the scores, therefore the OT-APST summated subscale scores were compared with individual items from the RPAB.

3.6 Variables

Dependent variables are the visual-perceptual and cognitive results from the different tools. Independent variables are age, gender, type of stroke, side of the stroke (whether it is on the left or right side of the brain).

3.7 Ethical Considerations

Ethical clearance was sought from the University of Witwatersrand Human Research Ethics Committee (Appendix F) as well as approval from the Research Committee to conduct the research.

The following granted the researcher permission to conduct the research: (i) Gauteng Department of Health (Appendix G), (ii) Chief Executive Officer of the Charlotte Maxeke Johannesburg Academic Hospital (Appendix H), (iii) Life Kensington Hospital (Appendix I) and (v) Netcare Rehabilitation Hospital (Appendix J)

Permission -was obtained from the head of the Occupational therapy department at each of the hospitals. Patients were given an information sheet which they could keep and they were verbally told what the research entailed. All patients who agreed to participate were required to sign a consent form and they were assured that their information would be kept confidential. The details of the patients were kept confidential and anonymity was maintained on the score sheets by only using codes. After completion of the research, the records will be kept for a minimum of six years.

Problems identified during the research were communicated to both the participant and their therapist. Before initiation of the research, it was determine that the

researcher had no conflict of interest. During the study, the researcher was blinded to maintain objectivity. The researcher only got a patient's score sheets from the assistant after all three tools had been completed by the given patient.

3.8 Budget

Description	Unit cost (R)	Number of items	Total cost (R)
Instrument	16 578,00	1	16 578,00

The patients were not given any transport money since they were all in-patients at the various hospitals. There was no need to include transport allowance as there is a university bus which goes to and from CHBAH and CMJAH.

3.9 Timeline

The research was to be conducted and finished within a year. Some of the procedures were applied for simultaneously.

Procedure	Time
Ethical clearance from HREC and Research committee	6-8 weeks (June-July 2012)
Clearance from the Gauteng department of health	6-8 weeks (Aug-Oct 2012)
Permission from the hospitals' Chief executive officer	2 weeks (Aug 2012)
Permission from the heads of department	1 week (Nov 2012)
Data collection	6 months (Nov 2012 - Apr 2013)
Data analysis, discussion and conclusion	6 months (Nov- March 2013)

The next chapter will show the results obtained from the research. Given the number of items in each tool, it was necessary to only present significant results

CHAPTER 4
RESULTS

INTRODUCTION

This chapter presents the findings of the study. Results will be discussed under the following major headings: Demographics of participants and comparison of tools which has three parts i.e.

- Comparison between OT-APST items and DLOTCA items
- Comparison between OT-APST items and RPAB items
- Comparison between OT-APST subscales and DLOTCA cognitive areas and/or RPAB items.

4.1 Demographics

4.1.1 Sample

The research initially intended on having between 32 to 50 participants with 32 participants being the minimum. As previously highlighted in the preceding chapters, only 32 participants participated in the research because of stringent inclusion criteria as well as time constraints.

4.1.2 Distribution of participants according to the hospitals

Three hospitals participated in the research namely Netcare Rehabilitation Hospital which contributed 50% of the respondents (n=16), Charlotte Maxeke Johannesburg Academic Hospital and Life Kensington Hospital each contributed 25% respondents (n=8 and n=8) as shown in Figure 4.1. Both Netcare Rehabilitation Hospital and Life Kensington Hospital are private hospitals and 75% of the participants were therefore from private hospitals.

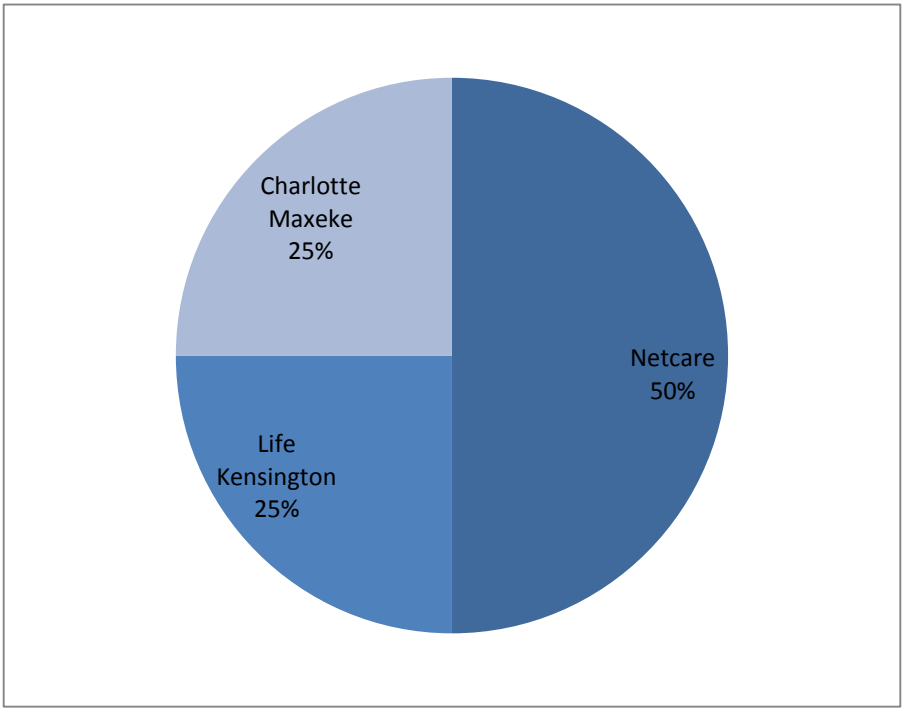

Figure 4.1 Distribution of the participants who participated according to hospitals (n=32)

4.1.3 Distribution of participants according to gender

The participants were evenly distributed with 16 female and 16 males participating (Figure 4.2).

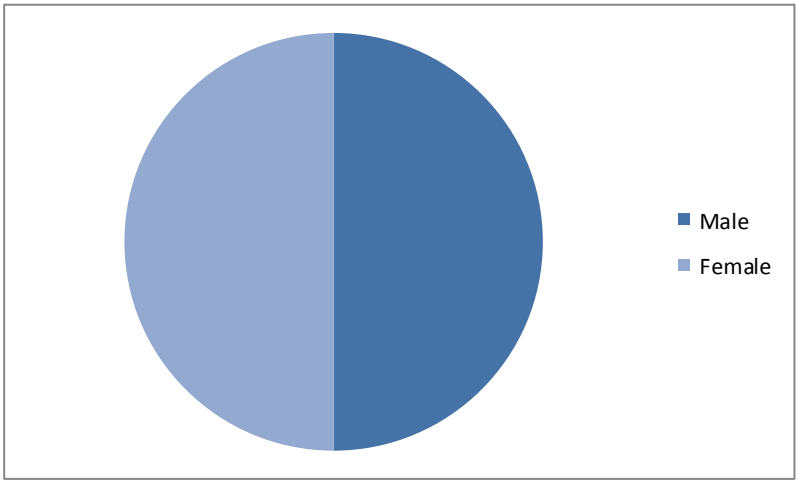

Figure 4.2 Distribution of the participants according to gender (n=32)

4.1.4 Distribution of participants according to age

Most of the participants were between 51 to 60 years ages as shown below (Figure 4.3).

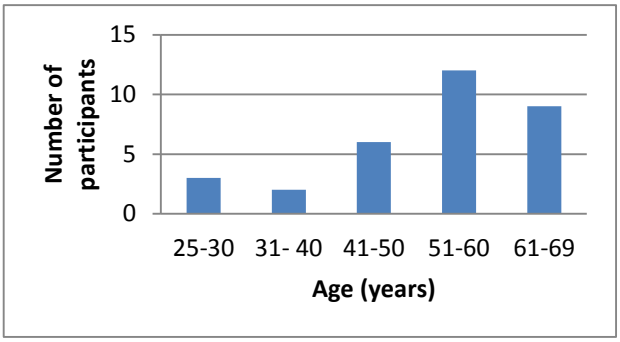

Figure 4.3 Distribution of the participants according to their age (n=32)

4.1.5 Hand dominance of participants

The majority of participants (n=28) were right handed (Figure 4.4).

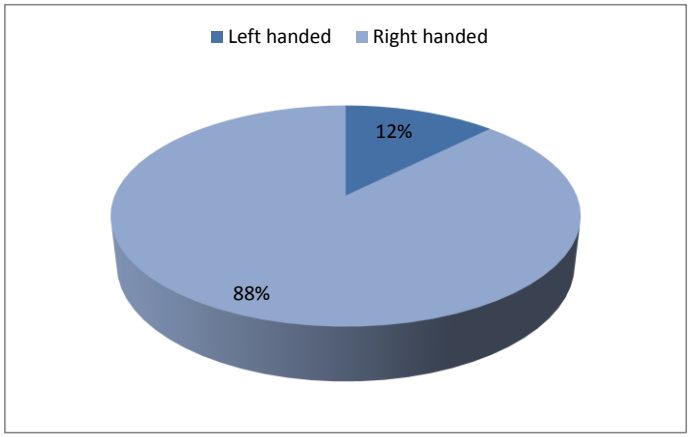

Figure 4.4 Distribution of participants according to hand dominance (n=32)

4.1.6 Distribution of participants according to the hemispheric side of the stroke

The majority of participants had cerebrovascular accident on the right hemisphere (Figure 4.5). There was only one patient with a stroke in the right basal ganglia.

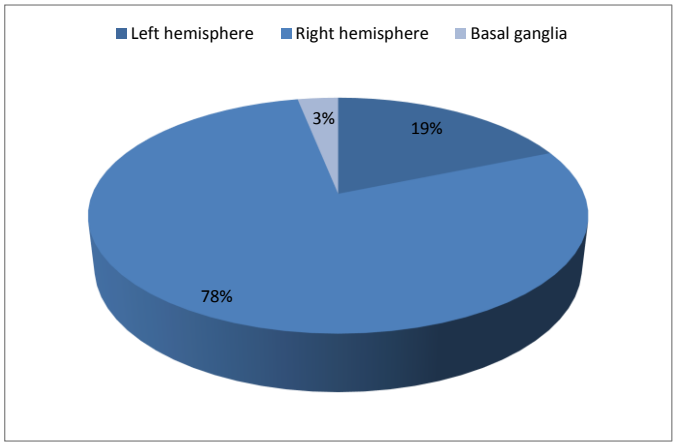

Figure 4.5 Distribution of participants according to the side of the stroke (n=32)

4.1.7 Order of tool administration

The order in which the tools were administered during the data collection is shown below. The administration of the tools was randomised; it was according to which participant was available and which tool administrator was also available. It was necessary to randomise the tool administration to reduce test-order effect. Twelve participants were evaluated with the OT-APST and 12 were also evaluated with the DLOTCA leaving 8 participants being evaluated with the RPAB in the first tool administration. For the second evaluation, five participants were evaluated with the OT-APST, 16 with the DLOTCA and 11 with the RPAB. In the third evaluation 15 participants were evaluated with the DLOTCA, nine with the RPAB and eight with the OT-APST.

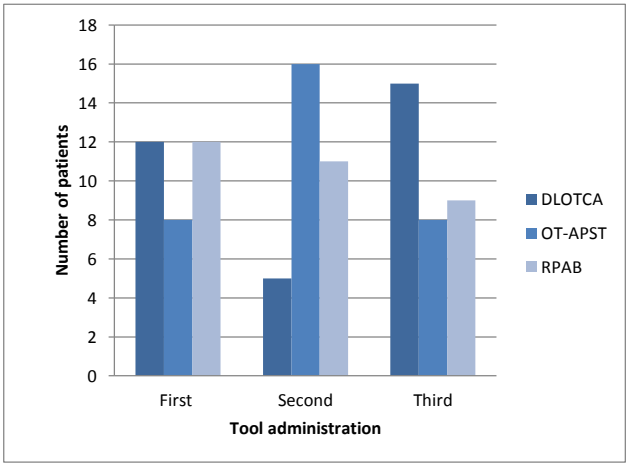

Figure 4.6 Graphic representation of the order of tool administration

4.2 Comparison of tools

In order to determine the degree to which the tools were related, correlations were used. Spearman's Rank-Order Correlations were used because the data was ordinal hence non-parametric statistics were used instead of Pearson's Product momentum which is used for normally distributed data (interval and ratio data). Strong correlations would be closer to +1,00 and a positive correlation indicates that as one variable increases, so does the other. The tools compared are cognitive perceptual tools evaluating similar constructs, hence similar constructs were expected to have positive, strong correlations. The raw scores from the OT-APST were first compared with the raw scores from the DLOTCA and then compared to the RPAB. Using the correlation interpretation of strength presented by Kielhofner (Kielhofner 2006) as guidelines correlations between;

- 0 and 0,2 are negligible
- 0,2 and 0,4 are low
- 0,4 and 0,6 are moderate (this will be split into 0,4 to 0,54 low moderate and 0,55 to 0,6 as moderate)
- 0,6 and 0,8 are high

- 0,8 to 1,00 are very high

The results shown are for correlations at or above 0,6 when rounded up. Correlations below the 0,6 ($p<0,05$) bench mark are considered too low to be significant. Correlations with values lower than 0,6 ($p<0,05$) can be referred to in Appendix K.

4.2.1 Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) and Rivermead Perceptual Assessment Battery (RPAB) compared to the Occupational Therapy Adult Perceptual Screening Test (OT-APST)

The DLOTCA has two scores for each item it has a 'Before mediation' score which is similar to the other two tools and an "After mediation' score. The 'After mediation' score is obtained after the therapist has given the participant cues on the failed item. Given that the OT-APST does not have a mediation score, it would be expected that it would correlate mostly with the DLOTCA 'Before mediation score'. The raw scores obtained on all the individual items of the DLOTCA, both 'Before mediation' score and 'After mediation' scores, were compared to the items on the OT-APST. The data was analysed using STATISTICA version 12. The results reveal that the majority of the OT-APST items which had significant correlations, correlated with the 'Before mediation' score for the DLOTCA. The mediation score is denoted with a letter M after the subscale name such as Geometric sequence 1-M.

The raw scores of the RPAB and OT-APST were used to determine the degree of correlation. Only correlations with values of 0,6 ($p<0,05$) when rounded up and above will be shown with the exception of expected correlations with values below 0,6. Correlations with values lower than 0,6 ($p<0,05$) can be referred to in Appendix K.

Both the DLOTCA and RPAB items will be compared in relation to OT-APST headings.

4.2.1.1 Colour Naming item of the OT-APST

Although the DLOTCA does not have any items related to Colour Naming, the OT-APST Colour Naming item correlated with the DLOTCA Orientation, Object

Identification, Directions on Client's Body and Spatial Relations on a Picture is shown in Table 4.1.

Table 4.1 Moderate to Strong Correlations between the raw scores of the OT-APST Colour Naming item and DLOTCA items

DLOTCA items	OT-APST Colour Naming
Orientation cognitive area:	
Orientation	0,617
Visual Perception cognitive area:	
Object Identification	0,748
Spatial Perception cognitive area:	
Directions on Client's Body	0,623
Spatial Relations on a Picture	0,692

The RPAB item similar to the OT-APST Colour Naming item is the RPAB Colour Matching item. The OT-APST Colour naming item only correlated with the RPAB Colour Matching (Table 4.2).

Table 4.2 Correlations between the OT-APST Colour naming item and RPAB items

RPAB items	OT-APST Colour Naming
Colour Matching	O,557

4.2.1.2 Object Naming item of the OT-APST

There were no significant correlations with any of the DLOTCA items on the OT-APST Object Naming item. The highest correlations were the DLOTCA Orientation and Object Identification items which had 0,418 and 0,357 respectively (Appendix K).

There was a poor correlation between the Object naming item of the OT-APST and the RPAB. The RPAB Object Matching item and OT-APST Object Naming had a very weak correlation (rho= -0,068). All other correlations with the RPAB were negligible to low moderate.

4.2.1.3 Shape constancy item of the OT-APST

The DLOTCA also has an item evaluating Object Constancy; The OT-APST Shape Constancy item lowly correlate with the DLOTCA Object Constancy item (Table 4.3).

Table 4.3 Correlations between the OT-APST Shape Constancy item and DLOTCA items

DLOTCA items	OT-APST Shape Constancy
Visual Perception cognitive area:	
Object Constancy	0,339
Praxis cognitive area:	
Motor Imitation	0,689
Visuomotor Construction cognitive area:	
Plain Block Design	0,594
Clock	0,674
Thinking Operations cognitive area:	
Picture Sequence-2	0,576
Geometric Sequence-2	0,579

The RPAB Size Recognition item is similar to the OT-APST Shape Constancy item. The OT-APST Shape Constancy item lowly correlated with the RPAB Size Recognition item (rho= 0,232 Table 4.4). The RPAB 3D Copying item moderately correlated with the OT-APST Shape Constancy item (rho= 0,637).

Table 4.4 Correlations between the OT-APST Shape constancy item and RPAB items

RPAB items	OT-APST Shape Constancy
Size Recognition	0,232
Body Image	0,566
3D Copying	0,637

4.2.1.4 Figure-Ground item of the OT-APST

The DLOTCA also has a Figure-Ground item. Although the two tools both Figure-Ground items there was a weak correlation (Table 4.5). However, a number of items in the DLOTCA correlated strongly with the OT-APST Figure-Ground item.

Table 4.5 Correlations between the OT-APST Figure-Ground item and DLOTCA items

DLOTCA items	**OT-APST Figure-Ground**
Visual Perception cognitive area:	
Object Identification	0,584
Figure-Ground	0,357
Spatial Perception cognitive area:	
Spatial Relations on a Picture	0,555
Visuomotor Construction cognitive area:	
Coloured Block Design –M	0,612
Plain Block Design-M	0,598
Puzzle –M	0,619
Thinking Operations cognitive area:	
Categorisation –M	0,583
Picture Sequence 2	0,567
Verbal Mathematical Questions -M	0,605

The mediation score is denoted with a letter M after the subscale name.

The RPAB has a Figure-Ground similar to the OT-APST. The Figure-Ground items from the two tools had a very weak correlation (rho= 0,276 Table 4.6).

Table 4.6 Correlations between the OT-APST Figure-Ground item and RPAB items

RPAB Items	**OT-APST Figure-ground**
Colour Matching	0,772
Animal Halves	0,588
Missing Articles	0,622
Figure-Ground	0,276

4.2.1.5 Reading item of the OT-APST

The DLOTCA does not have an item evaluating Reading. The OT-APST Reading item had the strongest correlations with the DLOTCA Copy Geometric Forms item (rho= 0,646 Table 4.7)

Table 4.7 Moderate to high correlations between the OT-APST Reading item and DLOTCA items

DLOTCA items	OT-APST Reading
Orientation cognitive area:	
Orientation	0,615
Visual Perception cognitive area:	
Object Identification	0,557
Spatial Perception cognitive area:	
Directions on client's Body	0,563
Visuomotor Construction cognitive area:	
Copy Geometric Forms	0,646
2D construction	0,573
Thinking Operations cognitive area:	
Geometric Sequence 1	0,602
Geometric Sequence 1 –M	0,592
Geometric Sequence 2	0,559
Geometric Sequence 2 –M	0,559

The mediation score is denoted with a letter M after the subscale name.

The only RPAB item with some reading is the Colour Matching item. The OT-APST Reading item moderately correlated with the RPAB Colour Matching item (rho= 0,559 Table 4.8). The OT-APST Reading moderately correlated with the RPAB Figure-Ground (rho= 0,571).

Table 4.8 Moderate Correlations between the OT-APST Reading item and RPAB items

RPAB items	OT-APST Reading
Colour Matching	0,559
Figure-Ground	0,571

4.2.1.6 Body Parts-Self item of the OT-APST

The DLOTCA has an item evaluating Body image named Directions on Client's Body. The OT-APST Body Parts-Self strongly correlated with the DLOTCA Directions on Client's Body (rho= 0,860 Table 4.9).

Table 4.9 Correlations between the OT-APST Body Parts-self and DLOTCA items

DLOTCA items	**OT-APST Body Parts-Self**
Spatial Perception cognitive area:	
Directions on Client's Body	0,860
Spatial Relations in Picture	0,585

The RPAB does not have an item similar to the OT-APST Body Parts-Self where the participant has to indicate a named body part. The OT-APST Body Parts-Self item only correlated with RPAB Colour Matching item (Table 4.10).

Table 4.10 Correlation between the OT-APST Body Parts-Self item and RPAB item

RPAB item	**OT-APST Body Parts-Self**
Colour Matching	0,571
Body Image	0,445

4.2.1.7 Body Parts-Therapist item of the OT-APST

In the DLOTCA Spatial Relations between Client and Objects Near Space, the participant also has to point to the therapist's body parts, similar to the OT-APST Body Parts-Therapist. The DLOTCA Spatial Relations between Client and Objects Near Space lowly correlated with the OT-APST Body Parts-Therapist. The OT-APST Body Parts-Therapist item correlated with two of the DLOTCA Praxis items i.e. the Motor Imitation and Symbolic Actions as well as the Directions on Client's Body (Table 4.11).

Table 4.11 Correlation between the OT-APST Body Parts-Therapist item and DLOTCA items

DLOTCA items	**OT-APST Body Parts-Therapist**
Spatial Perception cognitive area:	
Spatial Relations between Client and Objects Near Space	0,354
Directions on Client's Body	0,708
Praxis cognitive area:	
Motor Imitation	0,656
Symbolic Actions	0,597

The RPAB item which is vaguely similar to the OT-APST Body Parts-Therapist is the Body Image Self-Identification. There were negligible to low moderate correlations between the OT-APST Body-Parts Therapist and the RPAB items (Appendix K).

4.2.1.8 Left/Right on Self item of the OT-APST

The DLOTCA item similar to the OT-APST Left/Right on Self item is the Directions on Client's Body item. The OT-APST Left/Right on Self item strongly correlated with one DLOTCA item (Table 4.12).

Table 4.12 Correlations between the OT-APST Left/Right on Self item and DLOTCA items

DLOTCA items	OT-APST Left/Right on Self
Spatial Perception cognitive area:	
Directions on Client's Body	0,824

The RPAB does not have an item similar to the OT-APST Left/Right on Self item. There were negligible to low moderate correlations between the OT-APST Left/Right on Self item and the RPAB items (Appendix K).

4.2.1.9 Directions/Position item of the OT-APST

The item similar to the OT-APST Directions/Position item is the DLOTCA Spatial Relations on a Picture item. The OT-APST Directions/positions item had a moderate correlation with the DLOTCA Spatial Relations on a Picture item. The OT-APST Directions/Position strongly correlated with the DLOTCA Directions on Client's Body (Table 4.13).

Table 4.13 Correlation between the OT-APST Directions/Position item and DLOTCA items

DLOTCA items	OT-APST Directions/Position
Spatial Perception cognitive area:	
Directions on Client's Body	0,840
Spatial relations on a Picture	0,609

The RPAB does not have an item similar to the OT-APST Directions/Positions. There were also negligible to low moderate correlation between the OT-APST Directions/Positions item and the RPAB items (Appendix K).

4.2.1.10 Clock item of the OT-APST

The DLOTCA also has a Clock item similar to the OT-APST Clock item. The OT-APST Clock item lowly correlated with the DLOTCA Clock item (Table 4.14). The OT-APST item moderately correlated with the DLOTCA Puzzle and Categorisation items.

Table 4.14 Correlations between the OT-APST Clock item and DLOTCA items

DLOTCA Items	**OT-APST Clock**
Visuomotor Construction cognitive area:	
Puzzle	0,594
Clock	0,356
Thinking Operations cognitive area:	
Categorisation	0,610

There are no items similar to the OT-APST Clock in the RPAB. There were negligible to low moderate correlations between the RPAB items and the OT-APST Clock item (Appendix K).

4.2.1.11 House item of the OT-APST

The DLOTCA does not have an item which requires drawing a house like in the OT-APST House item. The OT-APST House item significantly correlated with a number of DLOTCA Visuomotor Construction items (Table 4.15).

Table 4.15 Correlations between the OT-APST House item and DLOTCA

DLOTCA items	**OT-APST House**
Visual Perception cognitive area:	
Object Constancy	0,576
Object Constancy –M	0,564
Praxis cognitive area:	
Motor Imitation	0,615
Motor Imitation –M	0, 692
Visuomotor Construction cognitive:	
Copy Geometric Forms	0,597
Two Dimensional Model	0,630
Pegboard	0,572
Pegboard –M	0,636
Coloured Block Design	0,554
Coloured Block Design –M	0,598
Puzzle	0,660
Thinking Operations cognitive area:	
Categorization	0,597
Categorization M	0,642
Picture Sequence 2	0,552

The mediation score is denoted with a letter M after the subscale name.

The RPAB does not have an item where the participant has to draw a house. The OT-APST House item significantly correlated with a number of RPAB items (Table 4.16).

Table 4.16 Correlations between the OT-APST House item and RPAB items

RPAB items	OT-APST House
Object Matching	0,692
Size Constancy	0,692
Animal Halves	0,619
Missing Articles	0,684
Figure-Ground	0,722
Sequencing	0,563
Body Image	0,594
Body Image Self Identification	0,640

4.2.1.12 Handwriting item of the OT-APST

The DLOTCA does not have an item evaluating handwriting as in the OT-APST Handwriting item. There were no significant correlations with the DLOTCA items, the highest obtained was a 0,385 ($p<0,05$) with the Directions on Client's Body item from the DLOTCA (Appendix K).

The RPAB does not have an item similar to the OT-APST Handwriting item. There are negligible correlations between the OT-APST Handwriting item and the RPAB items (Appendix K).

4.2.1.13 Telling Time item of the OT-APST

The DLOTCA also does not have an item where the participant has to tell time like the OT-APST Telling Time item. There were also no significant correlations with this item, the highest were with the Directions on Client's Body (rho= 0,519), Unstructured Riska Object Classification (ROC) (rho= 0,533) and Picture Sequence 1 (rho= 0,512).

The RPAB does not have an item similar to the OT-APST Telling Time item. There are negligible to low correlations between the OT-APST Telling Time item and the RPAB (Appendix K).

4.2.1.14 2 Dimensional Construction item of the OT-APST

Both the DLOTCA and the OT-APST have constructional items. The DLOTCA has a Two Dimensional Model item, which has a similar name to the OT-APST 2 Dimensional Construction item (rho= 0,683). The OT-APST 2 Dimensional Construction items had moderate to high correlations with all the DLOTCA Visuomotor Constructional items (Table 4.17).

Table 4.17 Correlations between the OT-APST 2 Dimensional Construction item and DLOTCA items

DLOTCA items	OT-APST 2 Dimensional Construction
Visual Perception:	
Object Constancy	0,554
Spatial Perception cognitive area:	
Directions on Client's Body	0,562
Praxis cognitive area:	
Motor Imitation	0,618
Visuomotor Construction cognitive area:	
Copy Geometric Forms	0,704
Two Dimensional Model	O,683
Pegboard	0,765
Pegboard –M	0,607
Coloured Block Design	0,674
Plain Block Design	0,805
Puzzle	0,707
Clock	0,615
Thinking Operations cognitive area:	
Categorization	0,712
Categorization –M	0,566
UROC	0,614
UROC –M	0,628
Picture Sequence 1	0,753
Picture Sequence 2	0,774
Picture Sequence 2 –M	0,685
Geometric Sequence 1	0,678
Geometric Sequence 1 –M	0,639
Geometric Sequence 2	0,656
Geometric Sequence 2 –M	0,637

The mediation score is denoted with a letter M after the subscale name.

The RPAB Cube Copying is similar to the OT-APST 2 Dimensional Construction item. The OT-APST 2 Dimensional Construction item strongly correlated with the RPAB Cube copying item (rho= 0,737 Table 4.18).

Table 4.18 Correlations between the OT-APST 2 Dimensional Construction item and RPAB items

RPAB items	**OT-APST 2 Dimensional Construction**
Colour Matching	0,655
Series	0,592
Missing Article	0,575
Sequencing	0,775
Body Image	0,768
3D Copying	0,682
Cube Copying	0,737

4.2.1.15 3 Dimensional Construction item of the OT-APST

The DLOTCA does not have an item similar to the OT-APST 3 Dimensional Construction item where the participant has replicate a given structure. The OT-APST 3 Dimensional Constructional item significantly correlated with a number of items from the DLOTCA (Table 4.19).

Table 4.19 Correlations between the OT-APST 3 Dimensional Construction item and DLOTCA items

DLOTCA items	**OT-APST 3 Dimensional Construction**
Orientation cognitive area;	
Orientation	0,651
Praxis cognitive area:	
Motor Imitation –M	0,604
Visuomotor Construction cognitive:	
Copy Geometric Forms	0,713
Two Dimensional Model	0,708
Pegboard	0,686
Coloured Block Design	0,634
Plain Block Design	0,575
Plain Block Design –M	0,553
Puzzle	0,742
Puzzle –M	0,562
Clock	0,604
Thinking Operations cognitive area:	
Picture Sequence 2	0,564
Geometric Sequence 1	0,600
Geometric Sequence 1 –M	0,603
Geometric Sequence 2	0,565

The mediation score is denoted with a letter M after the subscale name.

The RPAB 3D Copying item is similar to the 3 Dimensional Construction item. The OT-APST 3 Dimensional Construction item low moderately correlated with the RPAB 3D Copying item (rho= 0,460) but it moderately correlated with a number of RPAB items (Table 4.20).

Table 4.20 Correlations between the OT-APST 3 Dimensional Construction item and RPAB items

RPAB items	**OT-APST 3 Dimensional Construction**
Object Matching	0,604
Size Recognition	0,604
Series	0,619
Sequencing	0,622
3D Copying	0,460
Cube Copying	0,583
Body image Self identification	0,755

4.2.1.16 Calculations item of the OT-APST

The item similar to the OT-APST is the DLOTCA Verbal Mathematical Questions item. The OT-APST Calculations item significantly correlated with the DLOTCA Verbal Mathematical Questions item (Table 4.21).

Table 4.21 Correlations between the OT-APST Calculations item and DLOTCA items

DLOTCA Items	OT-APST Calculations
Orientation cognitive area:	
Orientation	0,622
Spatial Perception cognitive area:	
Directions on Client's Body	0,739
Spatial Relations between Client and Objects in Near Space	0,560
Spatial Relations on a Picture	0,609
Visuomotor Construction cognitive area:	
Two Dimensional Model	0,586
Coloured Block Design	0,614
Puzzle	0,627
Thinking Operations cognitive area: Categorization	0,562
UROC	0,668
Picture Sequence 1	0,676
Verbal Mathematical Questions	0,678

The RPAB does not have an item evaluating mathematical skills. The only strong correlation of this item with the RPAB was with the RPAB Colour Matching item (rho= 0,576).

4.2.1.17 Facial gesture item of the OT-APST

The DLOTCA has a number of praxis items similar to the OT-APST praxis although the methods of evaluation are different. The other OT-APST Praxis items did not yield significant correlations with the DLOTCA items i.e. the Stapler Use, Facial gestures on command, Wave to command and Wave to copy (Appendix K).

Table 4.22 Correlations between the OT-APST Facial gesture item and DLOTCA items

DLOTCA Items	OT-APST Facial gesture copy
Praxis cognitive area:	
Motor Imitation	0,158
Visuomotor Construction cognitive area:	
Two Dimensional Model	0,587

The RPAB does not have any items which assess praxis like the OT-APST Facial Gesture item. There were negligible to low correlations between the OT-APST Praxis items and the RPAB (Appendix K).

4.2.2 Subscales correlations

Raw scores of the performances were also compared using the total subscale score or cognitive area score to establish the correlations were applicable. The OT-APST subscales were compared with the seven DLOTCA cognitive areas. The RPAB does not have specific subscale or cognitive areas therefore, the OT-APST subscales were correlated to the individual items of the RPAB. Only correlations of 0,6 ($p<0,05$) and above when rounded up will be presented. Correlations with other subscales and cognitive areas will be presented as well.

4.2.2.1 OT-APST Agnosia subscale

The DLOTCA Visual Perception cognitive area had items similar to the OT-APST Agnosia subscale (rho=0,577 Table 4.23).

Table 4.23 Correlations between the OT-APST Agnosia subscale and the DLOTCA cognitive areas and the individual RPAB corresponding items

	OT-APST Agnosia
DLOTCA cognitive areas:	
Visual Perception	0,577
Spatial Perception	0,591
Praxis	0,664
Visuomotor Construction	0,710
RPAB items:	
Picture Matching	0,452
Object Matching	0,408
Colour Matching	0,676
Size Recognition	0,408
Figure-Ground	0,577

4.2.2.2 OT-APST Body scheme subscale

The RPAB Body Image item did not significantly correlate with the OT-APST Body Scheme subscale (Table 4.24).

Table 4.24 Correlations between the OT-APST Body scheme subscale and the DLOTCA cognitive area and individual RPAB items

	OT-APST Body scheme
DLOTCA cognitive area:	
Spatial perception	0,606
RPAB items:	
Body image	0,353
Body image Self-Identification	-0,02

4.2.2.3 OT-APST Unilateral neglect subscale

The DLOTCA Clock and RPAB cancelation items did not significant correlate with the OT-APST Unilateral subscale (Table 4.25).

Table 4.25 Correlations between the OT-APST Unilateral Neglect subscale and the individual reference tool items

	OT-APST Unilateral neglect
DLOTCA:	
Spatial perception cognitive area	0,557
Puzzle	0,551
Clock	0,440
RPAB items:	
Copying Shapes	0,725
Copying words	0,664
Cancellation	0,514

4.2.2.4 OT-APST Praxis subscale

There was a weak correlation between the OT-APST Praxis subscale and the DLOTCA Praxis cognitive area (Table 4.26).

Table 4.26 Correlations between the OT-APST Praxis subscale and DLOTCA Praxis cognitive area and RPAB item

	OT-APST Praxis
DLOTCA cognitive area:	
Praxis	0,436
RPAB item:	
Body Image Self-Identification	0,625

4.2.2.5 Constructional skills subscale

The OT-APST Constructional skills subscale significantly correlated with a number of the DLOTCA cognitive area (Table 4.27).

Table 4.27 Correlations between the OT-APST Constructional subscale and DLOTCA cognitive areas and individual RPAB items

	OT-APST Constructional skills
DLOTCA cognitive areas:	
Visuomotor construction	0,903
Visuomotor construction –Mediation	0,684
Visual perception	0,639
Spatial perception	0,636
Praxis	0,629
Praxis – Mediation	0,565
RPAB items:	
3D Copying	0,707
Cube copying	0,761
Body Image	0,728

4.2.2.6 OT-APST Acalculia subscale

There was a strong correlation between the OT-APST Acalculia and the DLOTCA Verbal Mathematical Questions item (Table 4.28).

Table 4.28 Correlations between the OT-APST Acalculia subscale and the DLOTCA cognitive area and Verbal Mathematical Questions item

	OT-APST Acalculia
DLOTCA:	
Spatial Perception cognitive area	0,742
Verbal Mathematical Questions item	0,690

CHAPTER 5
Discussion

INTRODUCTION

The aim of the study was to determine the convergent validity of the Occupational Therapy Adult Perceptual Screening Test (OT-APST) by comparing it with two commonly used cognitive-perceptual tools i.e. the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) (Appendix B) and the Rivermead Perceptual Assessment Battery (RPAB) (Appendix C). The objectives were to first compare similar constructs between the OT-APST and the two reference tools. It was important to critically look at the administration of the items in the tools in order to establish whether the items were evaluating similar constructs. The correlations between these similar constructs will be discussed. There were also some unexpected correlations between items and these were also revealed in this study.

This chapter gives a description of the tools and why certain items in the tools significantly correlated and how other correlations were incidentals. The first section, will give a brief introduction to the characteristics of the patients. The second section, will give a recap on the cognitive-perceptual tools which were used in this study. The third section on theoretically similar construct will address the first two objectives of this research on identifying theoretically similar construct of the OT-APST and reference tools (DLOTCA and RPAB). The fourth section will address the first two objectives of this research on the identifying theoretically similar constructs as well as address the third and fourth objective on comparing the individual items of the OT-APST with the reference tools. The last section will be comparing the OT-APST subscales with the DLOTCA cognitive areas and individual RPAB items.

5.1 Demographic characteristics of participants

The patients with auditory-receptive aphasia were excluded from the study mainly because the OT-APST was not suitable for these patients. A number of patients were excluded also because of language barriers as translating the instruments

would have affected the validity of the tools. The research had a total of 32 participants from three different hospitals. The two private hospitals, Netcare Rehabilitation Hospital and Life Kensington Hospital, respectively contributed 50% and 25% each to the sample and Charlotte Maxeke Johannesburg Academic Hospital, a government hospital, contributed the other 25% (Figure 4.1)**.** The private hospitals contributed 75% of the participants mainly because these patients were medically stable and therefore fitted the inclusion criteria. The government hospital is an acute hospital and patients often only just had a stroke. These patients were then often disorientated, unable to follow instructions, unable to complete all three tools in the allocated time frame and were therefore excluded from the study. Whereas the private hospitals, are rehabilitation centres which cater for medically stable participants who require more intensive rehabilitation services. There were equal numbers of male and female participants (16 males and 16 females) (Figure 4.2). The majority of the participants (n=27) were above the age of 40 (Figure 4.3) which is consistent with the general notion that the incidence/prevalence of strokes increases with age (Schmidt, Roesler et al. 2004). Seventy-eight percent (78%, n=25) of the participants had a stroke on the right side of the brain (Figure 4.5). This was due to the exclusion criteria which specified the exclusion of patients with aphasia. Therefore, only a few participants (n=6) with a left hemisphere stroke, but without aphasia, could be included in the study. It was interesting to note that the distribution of right-handed and left-handed participants from this study is indistinguishable with the general population distribution of ~90% right-handed to ~10% handed people (Knecht, Deppe et al. 2000) (Figure 4.4).

5.2 Cognitive-perceptual assessment and screening tools

Previous research by Cooke et al. (Cooke DM, McKenna K et al. 2006a), used the LOTCA and the LOTCA-G to determine the convergent validity of the OT-APST while in Brown et al research, they used the Neurobehavioural Cognitive Status Examination (Cognistat) and Developmental Test of Visual Perception- Adolescent and Adult (DTVP-A) (Brown, Mapleston et al. 2011). The OT-APST is a tool which was developed out of the need for a screening tool for visual perceptual problems and apraxia following stroke or other traumatic brain injuries (Cooke, McKenna et al. 2005). While the author of the tool said the OT-APST demonstrated validity, an

independent study by Brown et al., found conflicting results when the OT-APST was compared against the Cognistat and the DTVP-A. The DLOTCA is an improved version of the LOTCA which is an assessment tool that was designed to identify cognitive problems following head injury and it contains cognitive areas/subscales relating specifically to visual perception (Itzkovich, Elazar et al. 2000). The most prominent feature about the DLOTCA which differs from the LOTCA is the dynamic aspect of it which entails mediation e.g. if a patient does not get the item correctly, the therapist will cue him and then the patient is given an 'After mediation score' (Katz, Livni et al. 2011). The other reference tool is the RPAB: an assessment tool designed to identify visual perceptual problems following either a stroke or head injury (Whiting, Lincoln et al. 1985). The tools were compared using the constructs in the OT-APST as guidelines since some constructs of visual perception are not covered in the primary focus of the research, the OT-APST.

Interestingly, while the DLOTCA allows for mediation, most of the OT-APST constructs comparable with the DLOTCA significantly correlated with the 'Before Mediation score', which is logical since the OT-APST does not have an 'After mediation score'. Six of the seven OT-APST subscales that were correlated will be discussed under the Subscales. These include: Agnosia, Body scheme, Unilateral neglect (Body scheme and Unilateral neglect falls under Visuospatial relations), Constructional skills, Praxis and Acalculia.

5.3 Theoretically similar constructs

The first two objectives were to identify theoretically similar constructs from the DLOTCA and then the RPAB with the visual perceptual constructs included in the OT-APST.

Some of the constructs in the tools had different names but on looking at the administration procedure, it was clear that they were measuring the same construct. Constructs such as the OT-APST Shape Constancy, the RPAB Size Recognition are all evaluating constancy. Some constructs such as Figure-Ground were named exactly the same in all three tools. These items and more will be discussed under the Comparison of individual tool items section.

5.4 Comparison of individual OT-APST items

Objective 2 and 3 were to compare the individual items from the OT-APST with the DLOTCA and the RPAB.

5.4.1 OT-APST Agnosia individual items

The OT-APST Colour Naming, Stapler Naming, Figure-Ground, Shape Constancy and Reading items contribute to visual agnosia hence are classified under Agnosia in the OT-APST.

Colour Naming: The Colour Naming item is part of colour constancy. In the OT-APST Colour Naming item, the patient is asked to name the different colours presented which are yellow, orange, green, blue, red and black (Cooke 2005). The DLOTCA does not have any items specifically evaluating colour constancy, however, the OT-APST Colour Naming item highly correlated with the DLOTCA Object Identification (rho= 0,748), DLOTCA Direction on Client (rho= 0,623), DLOTCA Spatial Relations in Picture (rho=0,692) as well as DLOTCA Orientation (rho= 0,617), (Table 4.1). It was previously reported that in order to have an intact constancy, one has to be able to recognise the presented stimuli to name it accurately (Riddoch and Humphreys 1987). It therefore makes sense that the OT-APST Colour Naming highly correlates with the DLOTCA Object Identification (rho= 0,748), DLOTCA Directions on Client (rho= 0,623) and DLOTCA Spatial Relations in Picture (rho= 0,692) as the basis for getting these items correct is the recognition of the named object in the picture or environment, which is agnosia (Huberle, Rupek et al. 2012), (Riddoch and Humphreys 1987).

The DLOTCA Orientation item highly correlated (rho=0,617) with the OT-APST Colour Naming item. This can be due to the fact that visual perception is an active process which requires attention (Greene 2005). This argument would then also hold true for the correlation of the DLOTCA Orientation item with all the other OT-APST items. Analysis of the data, however revealed that this was not the case with OT-APST Object Name (rho= 0,418), OT-APST Shape Constancy (rho= 0.4) and OT-APST Figure-Ground (rho= 0,442) had low moderate correlations with the DLOTCA Orientation item. One therefore has to consider the possibility of chance to this particular correlation.

The RPAB item which is similar to the OT-APST Colour Naming is the Colour Matching test where the patient assembles coloured disks in labelled columns for red, blue, yellow and green (Whiting, Lincoln et al. 1985). Even though both the RPAB Colour Matching and the OT-APST Colour Naming assess the colours red, blue, yellow and green, the RPAB Colour Matching has an added component of colour matching by using different shades. The matching of colours under different illuminations (Smithson 2005) is however another way of evaluating colour constancy. Both these items (RPAB Colour Matching and OT-APST Colour Naming) are assessing colour constancy although the matching of different shades of the same colour can be seen as more difficult than just naming the colour. As expected then, there was a moderate correlation between these two colour constancy items (rho= 0,557) (Table 4.2) as the two items were assessing the same construct.

In the RPAB, the Colour Matching item also required some reading as the labels had e.g. the word 'blue' printed on it. The patient had to be able to read the labels for each column correctly to be able to correctly align the coloured disks according to the word on the label. The requirement for reading without a cue for the colour block complicated the colour constancy item in the RPAB but this did not appear to affect the correlation between the RPAB Colour Matching and the OT-APST-Colour Naming items.

Object Name (Stapler): In the OT-APST, the patient is given an actual stapler and is asked to name it. This item measures object constancy and it has a strong naming cognitive component to it too (relies on memory to name the object and to recall its use). In the DLOTCA, the item evaluating object constancy is the Object Identification item where the patient is given eight cards with line drawings and asked to name each object. The DLOTCA Object Constancy item also evaluates object constancy, as the name suggests and here, the patient is shown four pictures of daily objects taken from peculiar angles (Katz, Livni et al. 2011). The OT-APST Object Name lowly correlate with the DLOTCA Object Identification item as expected (rho=0,358 $p<0.05$). The reason might be that the OT-APST used an actual object while the DLOTCA items were only 2D pictures of objects. In the OT-APST Object Name, the patient could hold the object which would have

provided additional tactile cues including stereognosis making recognition easier. The participants also had an option of showing the therapist how to use the tool if they could not name the stapler with the added advantage of getting it right. This is something the therapist, using the OT-APST, needs to be weary of as this object constancy item is very easy and uses the tactile sensory system.

The DLOTCA Object Constancy item weakly correlated (rho= -0,03) with the OT-APST Object Name item. To further complicate the performance on the DLOTCA Object Constancy item, the orientation of the pictures did not clearly show the depth of the objects as well as the unique features and how the objects are ordinarily seen in relation to gravity, particularly for the fork and hammer. These aspects have been documented to influence one's ability to recognise an object (Humphreys and Riddoch 1984). The picture with the car was the easiest to identify for most participants illustrating how the orientation to gravity plays an important role in object identification as the car is in the correct orientation to the ground.

The OT-APST Object Name item lowly correlated with the other DLOTCA items.

Object Matching is a RPAB item similar to the OT-APST Object Name item where 10 physical objects are presented. The therapist demonstrate how to pair one set and then the patient has to pair the remaining 8 objects: 2 toothbrushes, 2 matchboxes, 2 cars, and 2 combs (Whiting, Lincoln et al. 1985). Although in the RPAB, this item is labelled as evaluating 'form constancy' (herein referred to as object constancy) it is actually evaluating visual discrimination. The RPAB Object Matching pairs of objects are all exactly the same in terms of their colour and size i.e. the exact same car model is used for the pair of cars and the exact same match box etc. The OT-APST Object Name and the RPAB Object Matching had negligible correlations (rho= -0,068). This might be due to the fact that although the items seem to evaluate the same construct, they are in actual fact evaluating different visual perceptual skills, i.e. visual discrimination versus object constancy. Another possible reason for the weak correlation might be due to the difference in the number of objects with the RPAB having eight objects which the patient had to match while the OT-APST only had one object which the patient had to name or show use of. The items used in the RPAB were also more everyday items (cup,

car, comb, matches and toothbrush) compared to the OT-APST which had only a stapler. The RPAB item further did not require naming of the objects while in the OT-APST the patient had to name the object. It is reasonable to assume that the naming requires an additional cognitive aspect namely concept formation compared to the simple matching of objects. It is therefore clear that the OT-APST Object Name item requires more from the patient than the RPAB Object Matching item.

Shape Constancy: In the OT-APST the Shape Constancy item is where the therapist demonstrates and names the different shapes before asking the patient to point to a particular shape i.e. point to all the squares, triangles, circles and rectangles (Cooke 2005). The DLOTCA does not have an item similar to the OT-APST Shape Constancy item. However the OT-APST Shape Constancy item highly correlated with the DLOTCA Motor Imitation (rho= 0,689), Plain Block Design (rho= 0,594), Clock (rho= 0,674), Picture Sequence-2 (rho= 0,576) and Geometric Sequence-2 (rho= 0,579) (Table 4.3). It would seem like constancy is a perceptual skills which is needed for visual-motor integration.

The RPAB does not have an item specifically looking at geometric shapes however it contains subscales which look at form constancy such as the previously mentioned Object Matching as well as Size Recognition, and Picture Matching. In the RPAB Size Recognition, the patient has to pair four sets of cards, one card with a large line drawing of e.g. a hat and the patient has to find another card with a smaller version of the same hat. The RPAB Size Recognition item which had should have highly correlated with the OT-APST Shape Constancy because the item both had stimuli or diagrams of different sizes in both the tools (rho=0,232 $p<0,05$ Table 4.4). Upon analysis of the raw scores, participants generally performed better on the RPAB Size Recognition suggesting the pictures were easier than the geometric shapes in the OT-APST. The Picture Matching subscale has 4 sets of coloured cards of different fruits and the patient has to pair the same fruit together (Whiting, Lincoln et al. 1985). Table 4.4 shows how the OT-APST Shape Constancy correlated with completely unrelated items which were purely coincidental. The reason behind the poor correlation with the

expected subscale might be due to the OT-APST had geometric forms whilst the RPAB had line drawings of objects such as a hat, house and shoes.

Figure-Ground: The OT-APST, the DLOTCA and the RPAB all have a specific Figure-Ground item, but what differs is the number of items embedded in the pictures. The OT-APST has a picture with five objects superimposed and the patient is asked to name the objects in the picture (Cooke 2005). The DLOTCA has two cards for Figure-Ground with three objects superimposed on each card and the patient has to name the objects on the cards as well (Katz, Livni et al. 2011). The DLOTCA and the OT-APST Figure-Ground items both had a line drawing of objects and were in black and white (Katz, Livni et al. 2011) but they unexpectedly had a low correlation (rho= 0,357) (Table 4.5). Figure-Ground in OT-APST has more objects embedded in the picture and requires naming whilst in the DLOTCA the patient could name the item or state the use of the item in the pictures. This might account for the discrepancy between the performances. The objects in the DLOTCA are also related objects with one card of three fruits superimposed and the other card of three tools (Katz, Livni et al. 2011), whilst in the OT-APST the superimposed objects are not related and include an umbrella, fork, apple, balloon and a cup (Cooke 2005). This might be another reason for the low correlation.

A number of items in the DLOTCA correlated moderately with the OT-APST Figure-Ground items such as the DLOTCA Object Identification (rho= 0,584), the DLOTCA Spatial Relations on a Picture (rho= 0,555), three Visuomotor Construction items as well as three of the thinking operations items (Table Table 4.5). In the DLOTCA Object Identification item, the patient had to name the items presented similar to the OT-APST Figure-Ground item although the DLOTCA items were presented one at a time. In the DLOTCA Spatial Relations On a Picture item the patient had to separate the foreground of the man from the background of his surroundings to be able to correctly identify any object (Katz, Livni et al. 2011). This item therefore clearly requires some figure-ground perceptual skills and it moderately correlated with the OT-APST Figure-Ground item (rho=0,555). The OT-APST Figure-Ground item further correlated with the DLOTCA Visuomotor Construction items namely the Coloured Block Design (rho =

0.612), the Plain Block Design (rho = 0.598) as well as the Puzzle item (rho = 0.619). These items all required some depth perception for the patient to be able to replicate the same design or build the puzzle. Interestingly, the OT-APST Figure-Ground correlated with the Block Designs and Puzzle item after mediation. More research is required to determine the link between the OT-APST Figure-Ground and the DLOTCA 'after mediation' scores.

The OT-APST Figure-Ground item also moderately to highly correlated with the DLOTCA Thinking Operations cognitive domain items: DLOTCA Categorisation (rho= 0,583), Picture Sequence (rho= 0,567) and Verbal Mathematical Questions (rho= 0,605). The Thinking Operations cognitive area requires more reasoning as compared to the other DLOTCA cognitive areas. Given that Figure-Ground is a visual cognitive skill, this may serve to provide further evidence of how intricately linked cognition and perception are.

In the RPAB Figure-Ground item there is the stimuli picture (with four overlapping objects) and eight cards with objects (four objects represented in the stimuli picture and four objects not represented in the picture) (Whiting, Lincoln et al. 1985). Essentially the patient has to match the items on the stimuli picture with the cards displaying individual items. The cards provide cues for the patient and give them something to look for unlike the OT-APST Figure-Ground where the patient is identifying objects without cues and they have to name the objects. All three tools use unrelated objects in their Figure-Ground items. The RPAB Figure-Ground had a low correlation (rho= 0,276 Table 4.6) with the OT-APST Figure-Ground possibly because of the difference in administration options. In the RPAB, the patient has to outline the object (with a finger/pen) given on the cards in the main stimuli picture. The individual cards provide cues for the patient and give them something to look for unlike the OT-APST Figure-Ground where the patient is identifying objects without cues and has to name the objects. There was also negative marking for wrong answers (Whiting, Lincoln et al. 1985) which affected the scoring. Especially with the anchor in the stimuli picture and the patient had to choose from an anchor and pick (tool). The pick is presented before the anchor and most would often choose the pick (negative marking) and then the anchor. Although the RPAB picture cards made it easier, the negative marking also made

it more difficult and in the end, the performance between the OT-APST and RPAB Figure-Ground items was almost the same.

Remarkably, the OT-APST Figure-Ground item highly correlated with the RPAB visual closure items: Missing Article (rho= 0,622) and Animal Halves (rho= 0,588). One reason might be the border assignment aspects which are required for Figure-Ground as previous research has highlighted (Shah, Holmes et al. 2007) possibly because the patients use border assignment to complete the RPAB visual closure items. The border assignment is most prominent especially with the participants' performance on the anchor which differed from the pick by having two 'arrows' at the end of the anchor whilst the pick did not have the 'arrows' i.e. the patients are first presented with a pick and using the borders on that picture, they wrongly identify it in the stimuli picture and when presented with anchor, they adjust the borders of the same object correctly.

The OT-APST Figure-Ground item highly correlated with the RPAB Colour Matching item (rho= 0,772). This is possibly due to the fact that the patient needs to find the same colour items from a colour enriched background, (the colour pieces are mixed). Therefore, the patient needs Figure-ground to be able to correctly identify the colour pieces.

Reading: The OT-APST has a passage from which the patient has to read from to assess their reading abilities (Cooke 2005), but in the DLOTCA and RPAB, there is no formal reading assessment. The OT-APST Reading item would be expected to highly correlate with Figure-Ground in the two reference tools because Figure-Ground has been documented to impact on the reading abilities of an individual (Schneck 2010). The DLOTCA Figure-Ground had a weak correlation with the OT-APST Reading item (rho=0,298 Table 4.7). This might be due to the fact that the ability to read is complex in nature and is influenced by a number of underlying components apart from Figure-Ground.

There were some unexpected moderate to strong correlations between DLOTCA items such as Orientation (rho= 0,615), Object Identification (rho= 0,557), Direction on Client (rho= 0,563), Copy Geometric (rho= 0,646), 2D Construction

(rho= 0,573), Geometric sequences (rho= 0,559 to 0,602) and the OT-APST Reading item (Table 4.7).

The one item in the RPAB where the reading skills were required is the Colour matching where the patient has to read the labels (Whiting, Lincoln et al. 1985). Interestingly, the RPAB Colour Matching item did moderately correlated (rho= 0,559 Table 4.8) with the OT-APST Reading item although the RPAB has single words compared to the OT-APST item which has a whole paragraph. The OT-APST Reading item also moderately correlated with the RPAB Figure-Ground item (rho= 0,571) but not the DLOTCA Figure-Ground item. This discrepancy could be due to the RPAB Figure-Ground containing more items compared to the DLOTCA and therefore more complex in nature.

5.4.2 OT-APST Visuospatial relations individual items

Under the subscale of Visuospatial relations are two other major headings namely Body scheme and Unilateral neglect in the OT-APST (Cooke 2005). Body Scheme has the following items: Body Parts-Self, Body Parts-Therapist, Left/Right on Self and Directions/Positions. While the Unilateral Neglect subscale has Clock, House, Handwriting, Reading and Telling the Time.

5.4.2.1. Body scheme

Body Parts-Self: In the OT-APST, the patient is asked to point to different parts of his/her body (Cooke 2005). In the DLOTCA, the items corresponding to the OT-APST Body Scheme subscale are the items under the Spatial Perception cognitive area which include the Directions on Client's Body, Spatial Relations between Client and objects in Near Space and Spatial Relations on a Picture. The item similar to the OT-APST Body Parts-Self in the DLOTCA is the Direction on Client's Body where the patient has to show a specified body part e.g. show me your right hand or put your left hand on your right ear (Katz, Livni et al. 2011). The OT-APST Body Parts-Self very highly correlated with the DLOTCA Directions on Client's Body (rho= 0,860 Table 4.9) even though the OT-APST Body Parts-Self does not have an element of either left or right which is present in the DLOTCA Directions on Client's Body. This aspect makes the DLOTCA item more difficult relative to the OT-APST item but did not appear to affect the correlation between these two items.

The OT-APST Body Parts-Self moderately correlated with the DLOTCA Spatial Relations on a Picture (rho= 0,585). It is possible that one needs an intact body scheme for spatial perception which might explain this correlation.

In the RPAB, the item similar to the OT-APST Body Parts-Self is the Body Image where the patient has to put together parts of a body in the correct orientation (Whiting, Lincoln et al. 1985). The OT-APST Body Parts-Self and the RPAB Body Image had a weak correlation (rho= 0,445 Table 4.10). This can be due to the fact that the RPAB Body Image has a strong spatial element to it (identify body parts in isolation as well as a strong visual closure element (how to join the body parts to the trunk). The OT-APST Body Parts-Self therefore, seems easier than the RPAB Body Image because the OT-APST item is related to the person whereas the RPAB item has disassembled body parts scattered around the trunk making it more challenging.

There was moderate correlation between the OT-APST Body Parts-Self and the RPAB Colour matching (rho= 0,559) which is coincidental.

Body Parts-Therapist: In the OT-APST, the patient is asked to point to a body part on the therapist (Cooke 2005) without specifying the side of the body part i.e. left/right. The DLOTCA the Spatial Relations between Client and Objects in Near Space item has two questions which correspond to the OT-APST Body Parts-Therapist. The DLOTCA Spatial Relations between Client and Objects in Near Space item asks the patient to point to the therapist's right eye and left shoulder (Katz, Livni et al. 2011) but the correlation was low (rho=0,354 Table 4.11). This is possibly because the other two questions which are part of the DLOTCA Spatial Relations between Client and Objects in Near Space item relate to the environment unlike the OT-APST Body Parts-Therapist which is directed at the therapist only. Another possible reason contributing to the weak correlation between the two items may be that the DLOTCA item specified left and right whilst the OT-APST did not, making the DLOTCA more difficult relative to the OT-APST Body Parts-Therapist.

Other items the OT-APST correlated with are the DLOTCA Direction on Client's Body (rho= 0,708) and the DLOTCA Motor Imitation (rho= 0,656) (Table 4.11).

This can possibly be because of the emphasis on the left and right concept in the DLOTCA Direction on Client's Body and DLOTCA Motor Imitation. There is further a moderate correlation between the OT-APST Body Parts-Therapist and the DLOTCA Symbolic Actions (rho= 0,597). In the DLOTCA Symbolic Actions item, the patient has to mime an action as if they are using a utensil e.g. pretending to cut bread with a knife (Katz, Livni et al. 2011). Since there is nothing similar in terms of constructs between the DLOTCA Symbolic Actions and the OT-APST Body Parts-Therapist, the correlation observed is likely to be coincidental.

In the RPAB, the item remotely similar to the OT-APST Body Parts-Therapist is the Body Image Self-Identification where the patient has to imitate what the therapist does (Whiting, Lincoln et al. 1985) i.e. if the therapist touches her head, the patient has to do likewise. There were no significant correlations between the RPAB items and the OT-APST Body Parts-Self. It must be noted that this RPAB item has a major praxis component to it (Butler 2002) which is probably why there was a weak correlation between these two items. In the OT-APST Body Parts-Therapist the patient is just pointing to a named body part (Cooke 2005) which is different from copying a movement (more praxis required) without the therapist naming the part she has touched (Whiting, Lincoln et al. 1985).

Left/Right on Self: In the OT-APST, the patient has to point to a body part instructed by the therapist e.g. asking the patient to point to his/her left leg. In the DLOTCA the item which includes the left/right concept on the patient is the Directions on Client's Body under the Spatial Perception cognitive area (Katz, Livni et al. 2011). (In the DLOTCA Directions on Client's Body item, the patient has to indicate a specified body part). As expected, there was a strong correlation between the DLOTCA Direction item and OT-APST Left/Right on Self item (rho= 0,824 Table 4.12).

There are no subscales in the RPAB which evaluated left/right discrimination and there were no significant correlations between the OT-APST Left/Right on Self item and any of the RPAB items.

Directions/Position: The OT-APST Directions/Position item provides the patient with a red cylinder and a blue cube and the therapist verbally instructs the patient

on how to arrange the objects in relation to the other e.g. put the blue cube on top of the red cylinder (Cooke 2005). This item is evaluating spatial relations perception as defined in the literature review, especially between objects (Akbari, Ashayeri et al. 2011). In the DLOTCA, an item assessing spatial relations between objects is the Spatial Relations on a Picture were the patient has to answer questions relating to the relationship between objects in a picture, e.g. what is in front of the man (Katz, Livni et al. 2011). Although the OT-APST Directions/Position item is on a 3D level while the DLOTCA Spatial Relations on a Picture is on a 2D level, there was a high correlation between the two items (rho= 0,609 Table 4.13). The DLOTCA Directions on Client's Body also very strongly correlated with the OT-APST Directions/Position item (rho= 0,840) as both items were looking at the objects or body parts relative to the patient's position i.e. how the patient will position the block will be determined by how he/she is sitting. The OT-APST questions on Directions/Position also make reference to "from where you are sitting" p33 (Cooke 2005) which shows that the interpretation of the positioning is dependent on the point of reference.

The RPAB did not have an item evaluating spatial relations in the same manner as the OT-APST Direction/Position item. There were also no significant correlations between the OT-APST Direction/Position item and any of the RPAB items.

5.4.2.2. Unilateral neglect individual items

Unilateral neglect is when a patient is not able to orient to a side of his body (Manes, Paradiso et al. 1999). Unilateral neglect was evaluated using the OT-APST Clock, House , Handwriting, Reading and Telling the Time items (Cooke 2005).

Clock: In the OT-APST Clock item, the patient has to draw the outer line drawing of the clock face as well as the numbers (Cooke 2005). In the DLOTCA, there are no specific items which have been assigned to evaluating unilateral neglect but the closest items evaluating unilateral neglect are items from the Visuomotor Construction cognitive area which include the Clock and Puzzle items. The DLOTCA Clock item is administered differently from the OT-APST Clock item as the outer line drawing is provided and the patient has to only write in the numbers and put the hands at a specified time (Katz, Livni et al. 2011). The setting of a

specific time is however not stipulated in the OT-APST. The correlation between the OT-APST Clock and the DLOTCA Clock was low (rho= 0,356 Table 4.14) possibly due to the detail required in the DLOTCA Clock item, of placing the hands to a specified time which requires understanding of the concept of time making it more difficult relative to the OT-APST Clock item. The other DLOTCA item which was expected to correspond to the OT-APST Clock item is the Puzzle item where the patient is given pieces of a puzzle which are mixed and the patient has to build the puzzle on top of the picture (Katz, Livni et al. 2011). The DLOTCA Puzzle had moderate correlations (rho= 0,594) with OT-APST Clock.

The DLOTCA Categorisation item also highly correlated (rho= 0,610) with the OT-APST Clock item. In the DLOTCA Categorisation item, the patient is given cards with pictures of objects and they have to categorise these into groups (Katz, Livni et al. 2011). It is likely that in order for a patient to categorise the cards in the DLOTCA Categorisation item, one has to be able to scan both sides of their visual field hence a high correlation.

House: In the OT-APST House item, the patient is given a diagram of a house to copy and they have to replicate the drawing including all the elements in the given diagram (Cooke 2005). The OT-APST House item was expected to correlate with the DLOTCA Clock and Puzzle items which seem to be evaluating similar constructs. Again the OT-APST House item lowly correlated with the DLOTCA Clock item (rho= 0,316) possibly because the OT-APST House item requires copying which is more of a visual motor integration skill while the DLOTCA Clock item does not have that copying element to it. The OT-APST House item did however moderately to highly correlated with a number of the DLOTCA Visuomotor Construction cognitive area items such as Copy Geometric Forms (rho= 0,597), Two Dimensional Model (rho= 0,630), Pegboard (rho= 0,572) Coloured Block Design (rho= 0,554) and Puzzle item (rho= 0,660) (Table 4.15). It is logical that the Visuomotor Construction items require building or writing and unilateral neglect will affect such skills if one has neglect. The OT-APST House item also highly correlated with the DLOTCA Motor Imitation item (rho= 0,615) which might be due to the fact that to adequately imitate a motor action, one has to be able to orient to both sides of the body.

The OT-APST House item highly correlated with the RPAB (Table 4.16) Object Matching (rho= 0,692), Size Constancy (rho= 0,692), Animal Halves (rho= 0,619), Missing Articles (rho= 0,684), Figure-Ground (rho= 0,722), Sequencing (rho= 0,563) Body Image (rho= 0,594) and Body Image Self-Identification items (rho= 0,640). There is need for further investigation to ascertain the link between the unexpected RPAB items and the OT-APST House item.

The OT-APST House item had negligible correlations with the RPAB Inattention items which include Cancellation, Right/Left Copying Shapes and Words items which also evaluate Unilateral Neglect (Whiting, Lincoln et al. 1985). The method of evaluating unilateral neglect is different for the OT-APST and the RPAB. Although both tools were mainly using writing tasks to determine unilateral neglect, the quality of the outcome affected the results of the RPAB as the patient had to reproduce the exact same words as well as the shapes which are affected by the patient's fine motor skills. The RPAB requires more precision hence a greater need for good fine motor skills because if the patient reproduced a similar shape to the given shape but the height was wrong or the sides were not equal, the patient would not be credited for the item (Whiting, Lincoln et al. 1985). The OT-APST House item was also copied on a large surface whereas the RPAB shapes and words where to be copied in a significantly confined space which made it even more challenging. The RPAB Cancellation, Right/Left Copying Shapes and Words Inattention items weakly to lowly correlated with the OT-APST unilateral neglect items i.e. Clock, House, Handwriting and Reading. This may be due to the requirement for constructional skills in drawing or visual motor integration. The RPAB Cancellation task which strongly tapes into figure-ground skills required to identify the letters instructed. The weak correlation suggests the items are actually evaluating different constructs or different components of the same construct.

Handwriting, Reading and Telling the Time: The OT-APST Handwriting, Reading and Telling time items weakly to lowly correlate with any of the DLOTCA items or the RPAB items related to unilateral neglect. The OT-APST Reading item also contributes to the Agnosia and Functional Skills subscales. Although, the OT-APST Reading item correlated with the reference tools and in the tables, there were no unilateral neglect items which significantly correlated with the Reading

item. Similarly, in a study by Brown et al., they also found insignificant correlations between the OT-APST Unilateral Neglect subscale and all the items of the reference tools (Brown, Mapleston et al. 2011). It is important to note that in study by Brown et al., the reference tools also did not have a subscale specifically for unilateral neglect.

5.4.3. Praxis individual items

The OT-APST Praxis items include: Facial Gesture**,** Wave Right Hand, Wave Left Hand, Stapler Manipulation, Pen Use for Writing and Handwriting (Cooke 2005). Similar to literature on the assessment of praxis (Cermak, Morris et al. 1990), the OT-APST Praxis items evaluated movements on verbal command first with the patient being asked to demonstrate an action. If the patient is unable to perform the action on verbal command the therapist will demonstrate the movement and the patient has to copy/imitate the movement or the use of an utensil (pen and staple) (Cooke 2005).

In the DLOTCA, there is a specific Praxis cognitive area which includes Motor Imitation, Utilisation of Objects, and Symbolic Actions (Katz, Livni et al. 2011). In the DLOTCA Motor Imitation item, the therapist demonstrates a movement and the patient has to mirror the action, (as if looking in a mirror) (Katz, Livni et al. 2011). Although the DLOTCA Motor Imitation may appear to be similar to the OT-APST demonstrations, it differs in that if the therapist uses her right hand in demonstration, the patient has to use his/her left hand to mirror the therapist. This makes the demonstration in the DLOTCA more challenging. In the OT-APST, the demonstrations are only done if the patient is unable to perform the instructed action on verbal command (Cooke 2005), while in the DLOTCA Motor Imitation the therapist starts with the demonstrations and not the verbal command.

In the other DLOTCA Utilization of Objects item, the patient is given utensils and asked to demonstrate their use and in the Symbolic Actions item the patient has to mime an action without the objects, e.g. showing the therapist how to brush his teeth (Katz, Livni et al. 2011). Both the DLOTCA and the OT-APST have an utilisation of objects item but the difference in the two tools is related to the number of steps required in some of their tasks. The OT-APST items are more single step tasks, whilst the DLOTCA tasks require the patient to do more than

one step e.g. a patient is given an A4 paper and a small envelope and they have to fold the letter and put it in the envelope. The letter task in the DLOTCA is therefore, more complex than stapling a paper as required in OT-APST. This may explain why the OT-APST Stapler and Pen weakly correlate with the DLOTCA Utilization of Objects.

The OT-APST also does not have a praxis item similar to the DLOTCA Symbolic actions item. Clearly the levels of difficulty between the OT-APST and DLOTCA praxis items are different. Hence it was not surprising that the DLOTCA praxis items weakly correlated (rho= 0,436) with the OT-APST praxis items although they both evaluate 'similar' constructs. The administration of these items as well as their complexity affected the relationship. Table 4.22 shows that only the DLOTCA Two Dimensional Model moderately correlated (rho= 0,587) with the OT-APST Facial Gesture. It also shows the weak correlation between the DLOTCA Motor imitation (rho= 0,158) and the OT-APST Facial gesture copy (Table 4.22). The rest of the Praxis items from the OT-APST did not give significant results in this study.

The RPAB does not have a group of items or any individual item which has been explicitly labelled as evaluating praxis. However, when using the methods of evaluating praxis as highlighted in the literature, some of the RPAB items are similar to the OT-APST praxis items. One such RPAB item is the Body Image Self-Identification were the patient has to copy what the therapist does e.g. when she touches her head the patient copies this action and touches his/her head (Whiting, Lincoln et al. 1985). Similar to the DLOTCA, the RPAB Body Image Self-identification only evaluates one aspect, imitation, while the OT-APST starts with verbally asking the patient to demonstrate a certain action and only progresses to demonstration of the action if the patient is unable to perform an action on verbal command. Perseveration has been documented to be a consequence of apraxia (Wheaton, Fridman et al. 2009). In the RPAB Right/Left Copying Words (description under Unilateral Neglect) it would theoretically be expected to see participants with perseveration problems. However, there was also a low correlation between the RPAB items and the OT-APST possibly because different aspects of the same construct are being evaluated in the different tools. The

RPAB Body Image Self-identification (rho= 0,277) and all of the other RPAB items weakly to lowly correlated (rho= -0,273 to 0,331) with the OT-APST Praxis items. These results are consistent with what Butler (Butler 2002) previously determine i.e. that there is lack of consistence in performance for tools claiming to evaluate praxis which may be attributed to evaluating different aspects of praxis.

5.4.4. OT-APST Constructional skills Individual items

The OT-APST constructional skills subscale includes the following items: the Clock and House, 2-Dimensional (2D) Construction and 3-Dimensional (3D) Construction items. Some of the items have been previously discussed such as the graphic skills of the Clock and the House. The OT-APST 2D task is where the patient is given a 2D pattern and has to build the same pattern with cubes provided (Cooke 2005) while the 3D task is where the patient has to replicate a provided 3D structure (Cooke 2005). The OT-APST evaluation of constructional skills is similar to documented literature (Baum and Hall 1981), (Russell, Deidda et al. 2010) because it includes aspects of graphic, two-dimensional and three-dimensional items. The DLOTCA labels similar constructional items under the Visuomotor Construction cognitive area (Katz, Livni et al. 2011). When grouped into the different types of constructional skills (Baum and Hall 1981), the DLOTCA has:

- Graphic items: Copying Geometric Forms and Clock items;
- 2-D items:
    - Two-Dimensional Model item where the patient has to arrange some shapes according to a given design
    - Pegboard Construction item which is similar to the Two-Dimensional Model item only it uses pegs
    - Puzzle item which consists of cards and which does not quite fit in the graphic group (Katz, Livni et al. 2011).
- 3-D items: Plain Block Design and Coloured Block Design items.

Unlike the OT-APST 3-Dimensional Construction item, the DLOTCA does not have a model structure which the patient has to replicate from given pieces. It was expected that the graphic items from the OT-APST would strongly correlate with the corresponding graphic items from the DLOTCA likewise with the 2D and 3D items from the tools since the items are evaluating similar constructs. As previously highlighted, the OT-APST Clock weakly correlated with the DLOTCA graphic items. Reasons for the poor correlation between the Clock in the DLOTCA and OT-APST have been presented under Unilateral Neglect. The OT-APST Clock moderately correlates with the DLOTCA Puzzle (rho= 0,594 Table 4.14). Table 4.15 also shows how The OT-APST House item also moderately to highly correlate with five out of the seven DLOTCA Visuomotor Construction cognitive area items. The DLOTCA Visuomotor Construction items (Table 4.15) are Copy Geometric Forms (rho= 0,597), 2D Construction (rho= 0,630), Pegboard (rho= 0,572), Coloured Block Design (rho= 0,554), Puzzle (rho= 0,660). As expected, the OT-APST House item moderately correlated with the DLOTCA Copy Geometric Forms (rho= 0,597) because in drawing a house, there is use of basic geometric shapes which are used in the DLOTCA Copy Geometric Forms item. The OT-APST 2-Dimensional Construction item moderately to highly correlated with all the DLOTCA Visuomotor Construction cognitive area items (rho= 0,607 to 0,805 Table 4.17) and the expected correlations were with the DLOTCA Two-Dimensional skill items as grouped above. The OT-APST 3-Dimensional Construction item also moderately to highly correlated with all the DLOTCA Visuomotor Construction cognitive area items (rho= 0,553 to 0,742 Table 4.19). The significant correlations that were determined in the different constructional skill items supports Baum's notion that there is no significant difference between the performance of constructional skill items i.e. graphic versus 2D versus 3D (Baum and Hall 1981).

The RPAB does not have a label of constructional skills but uses the term Spatial Awareness for the similar group of items which includes 3D Copying and Cube Copying. The RPAB 3D Copying item is significantly more complex relative to the corresponding OT-APST 3-Dimensional Construction item. The RPAB 3D Copying item has 12 blocks which need to be placed in a precise orientation; the orientation of blocks is similar to the OT-APST. The RPAB 3D Copying item also

has a number of blocks, some of which are very similar but are not the same as the ones in the stimuli and the patient has to be careful in picking the blocks. In scoring the RPAB 3D Copying, the selection of cubes is also scored, which is different from the OT-APST. In the OT-APST 3-Dimension Construction item, the patient is not given extra blocks to confuse them. Due to the difference in complexity between the two 3D items from the OT-APST and RPAB, there was a weak correlation (rho= 0,460 Table 4.20). However, the OT-APST 3-Dimensional Construction item moderately correlated with the other RPAB constructional item (Table 4.20), i.e. the RPAB Cube Copying (rho= 0,583). It is possible the level of complexity of the RPAB Cube Copying was more matched to the OT-APST 3 Dimensional Construction item. Unexpectedly, the OT-APST 3-Dimensional Construction item also strongly correlated with Object Matching (rho= 0,604), Size Recognition (rho= 0,604), Series (rho= 0,619), Sequencing (rho= 0,622) and Body Image Self-identification (rho= 0,755). Discrimination is an underlying skill needed to be able to construct these RPAB items accurately and might explain these unexpected correlations.

In the RPAB Cube Copying the patient has to copy a design using cubes with different designs on them. This is exactly like the OT-APST 2-Dimensional Construction item, with the only differences being that the RPAB uses nine cubes throughout while the OT-APST gradually increases the number of cubes as well as that the RPAB cubes are significantly smaller than the OT-APST cubes. The OT-APST 2-Dimensional Construction item strongly correlated with the Cube Copying as expected (rho= 0,737 Table 4.18). The OT-APST 2-Dimensional Construction item also strongly correlated with the RPAB 3D Copying (rho= 0,682).

The OT-APST 2-Dimensional Construction item unexpectedly correlated with the RPAB Colour Matching (rho= 0,655), Series (rho= 0,592), Missing Article (rho= 0,575), Sequencing (rho= 0,775) and Body Image (rho= 0,768) (Table 4.18). Other than the Body Image, the other RPAB items require visual discrimination (matching) for the patient to complete the items correctly, which would most likely also be required in the OT-APST 2-Dimensional Construction item.

5.4.5. OT-APST Acalculia individual item

The DLOTCA has an item similar to the OT-APST Calculations item, the DLOTCA Verbal Mathematical Questions item. The OT-APST Calculations item surprisingly correlated with the DLOTCA Orientation (rho= 0,622), Directions on Client's Body (rho= 0,739), Spatial Relations between Client and Objects in Near Space (rho= 0,560), Spatial Relations on a Picture (rho= 0,609), Two Dimensional Model (rho= 0,586), Coloured Block Design (rho= 0,614) Puzzle (rho= 0,627), Categorisation (rho= 0,562), UROC (rho= 0,668) and Picture Sequence (rho= 0,676) (Table 4.21). Further analysis is required to ascertain the relationship between the DLOTCA and the OT-APST Calculations item.

5.5. Comparison of Subscales of the OT-APST

Objectives 5 and 6 of this research were to determine whether similar subscales on OT-APST and the reference tools would yield the same result and using correlations, a positive high correlation would indicate such a relationship. In order to achieve this objective, individual items in the different subscales had to be compared to establish which subscales were evaluating similar constructs, which was the second objective in this research (Appendix E).

5.5.2. Agnosia subscale

Visual agnosia is an inability to identify presented shapes or objects in light of intact visual receptive skill (Riddoch and Humphreys 1987). The items in the DLOTCA which corresponded to the OT-APST Agnosia subscale were Object Identification, Figure-Ground and Object Constancy and these items were grouped under the Visual Perception cognitive area (Katz, Livni et al. 2011). The Picture Matching, Object Matching, Colour Matching, Size Recognition and Figure-Ground from the RPAB were also included under agnosia. While problems in any naming item could be due to aphasia, it could be safely assumed that any problems in naming were due to problems in recognition and not aphasia (anomia) since participants with expressive aphasia were excluded from this study. It was expected that the items which fall under Agnosia from the three different tools would highly correlate since they are evaluating the same construct.

The Agnosia subscale of the OT-APST moderately correlated with cognitive areas in the DLOTCA i.e. Visual Perception cognitive area (rho= 0,577), Spatial

Perception cognitive area (rho= 0,591), Praxis (rho= 0,664) Visuomotor Construction (rho= 0,710) (Table 4.23). Previous research on the OT-APST compared subscales and in the research by Cooke et al, they found that the LOTCA Visual perception domain significantly correlated with the OT-APST Agnosia subscale (rho=0,508 p<0.01) (Cooke DM, McKenna K et al. 2006a). In the study, they had a large sample size of 73 hence correlations from 0,4 were considered significant (Cooke DM, McKenna K et al. 2006a). With the study done by Brown et al, the OT-APST Agnosia subscale did not significantly correlate with any of the reference tools with correlations 0,324 and below (Brown, Mapleston et al. 2011). The DLOTCA Visual Perception cognitive area has the Constancy and Figure-Ground items similar to the OT-APST Agnosia items as well, hence they were expected to give strong correlations. This study shows that the OT-APST Agnosia subscale has moderate to strong correlations with the DLOTCA Visual Perception cognitive area as well as other related DLOTCA cognitive areas as shown in Table 4.23. The RPAB does not add or group the related agnosia items hence they were compared with the Agnosia subscale individually (Table 4.23). The OT-APST Agnosia subscale and RPAB Picture Matching (rho= 0,452), Object Matching (rho= 0,408) and Size Recognition (rho= 0,408) items had low-moderate correlations and there is need to ascertain why the two tools have poor correlations. Perhaps not adding the items may contribute to why the RPAB agnosia items did not significantly correlate with the OT-APST Agnosia subscale. The RPAB Colour Matching (rho= 0,676) and Figure-Ground (rho= 0,577) items had strong and moderate correlations respectively.

5.5.3. Body scheme subscale

As mentioned in the above section, the body scheme subscale was compared with the DLOTCA Spatial Perception cognitive area (which includes Directions on Client's body, Spatial Relations between Client and Objects in Near space, and Spatial Relations on a Picture) because the two cognitive areas had comparable items. As expected, the DLOTCA Spatial Perception strongly correlated with the OT-APST Body scheme (rho= 0,606 Table 4.24). The OT-APST Body scheme subscale lowly correlated with comparable items from the RPAB (Table 4.24), this may be due to the OT-APST's subscale inclusion of aspects of left/ right which are absent in the RPAB item. Another factor for the weak correlation may be

because the Body Image Self-Identification is more of a praxis item than a body scheme hence the weak correlations. In previous research by Brown et al, the OT-APST Body scheme subscale significantly correlated with Cognistat and DTVP-A (Brown, Mapleston et al. 2011). In a study done by Cooke et al, they found that the OT-APST Body scheme significantly correlated with the LOTCA Spatial Perception subscale (Cooke DM, McKenna K et al. 2006a) this is consistent with the results found in this research, as shown in Table 4.24 with the DLOTCA Spatial perception cognitive area strongly correlated with the OT-APST Body scheme (rho= 0,606).

5.5.4. Unilateral neglect subscale

When compared with the whole OT-APST subscale i.e. Clock, House, Handwriting, Reading and Telling the time items added to give a subscale score (Table 4.25), the DLOTCA Spatial Perception cognitive area (rho= 0,557), and Puzzle item (rho= 0,551) moderately correlated with the Unilateral subscale. However, when examining the subscale as a whole i.e. with the contributing items added, the DLOTCA Clock item still low moderately correlated (rho= 0,440) with the subscale score suggesting that further analysis is necessary to ascertain the discrepancy between the performance of items evaluating similar constructs. When compared to the RPAB, the RPAB items evaluating Inattention i.e. the Right/Left Copying Words (rho= 0,664) and Shapes (rho= 0,725) strongly correlated to the OT-APST Unilateral subscale. However, the RPAB Cancellation which also evaluates unilateral neglect did not meet the cut-off point (rho= 0,514 Table 4.25). These results are different from those reported by Cooke et al, where they found that the unilateral neglect subscale had the highest correlations. (Cooke DM, McKenna K et al. 2006a). The OT-APST Unilateral neglect subscale is an added sum of items contributing to differences that were observed whilst the reference tools did not have an added sum of the items. Clearly this subscale is not far from the reference because in both cases, two of the three items moderately to strongly correlate with the OT-APST Unilateral neglect subscale.

5.5.5. Praxis subscale

The OT-APST Praxis subscale (sum of all the items under Praxis) low moderately correlated with the DLOTCA Praxis cognitive area. The OT-APST only evaluated

performance on verbal command and on imitation. The DLOTCA also evaluated performance with given objects and the motor imitation was more complex than what was required by the OT-APST. Additionally, the DLOTCA included a pantomime item which was absent in the OT-APST as well as instruction with a number of steps. The OT-APST Praxis subscale as a whole strongly correlated with the RPAB Body image self-identification item (rho= 0,625 Table 4.26). Interestingly, previous research on the OT-APST Apraxia subscale also revealed the lowest correlations that were still considered significant by Cooke et al. (using correlations from rho=0.4) (Cooke DM, McKenna K et al. 2006a). The difference in the levels of complexity between the various tools could account for the weak correlations.

5.5.6. Constructional subscale

As expected, the OT-APST Constructional subscale very highly correlated with the DLOTCA Visuomotor Construction cognitive area (rho=0,903 Table 4.27). The DLOTCA Visual Perception (rho= 0,639), Spatial Perception (rho= 0,636) and Praxis (rho= 0,629) cognitive area all highly correlated with the OT-APST Constructional Skill subscale. This data is consistent with a previous study by Murray et al where they determined that visual perceptual skills were multi-dimensional (Murray, Cermak et al. 1990).

With the RPAB, the OT-APST Constructional Skills subscale highly correlated with the RPAB 3D Copying Selection (rho= 0,707) and RPAB Cube Copying (rho= 0,761) as expected. Interestingly, it also strongly correlated with the Body Image (rho= 0,728 Table 4.27), although the RPAB Body Image items are named so, it is more consistent with evaluating Body Scheme and not image. The RPAB Body Image items require the patient to assemble a face and a body which is more of Body Scheme (O'Bien and Williams 2010). This is consistent with the fact that a patient needs to know where his/her body is in space in order to correctly build anything (faces, puzzles) or imitate postures. Cooke et al, also found a significant correlation between the LOTCA Visuomotor organisation skills and the OT-APST Constructional skills subscale (Cooke DM, McKenna K et al. 2006a).

5.5.7. Acalculia

In the OT-APST Acalculia, the patient has to add and subtract simple single digits sums and two digit sums (Cooke 2005). The numbers are arranged in a vertical orientation which makes it easier to calculate. Between the two reference tools, only the DLOTCA has an item on arithmetic i.e. the Verbal Mathematical Questions item were the participants have to read story-like scenarios, some use years (four digits) and other problems require higher cognitive/mathematical skills (e.g. “Joan was born before Liz and after Sharon. Who is the first born (Katz, Livni et al. 2011)). Table 4.28 shows the expected significant correlations between the OT-APST Calculations item and the DLOTCA Verbal Mathematical Questions item. In the previous research done by Cooke et al with the OT-APST and the LOTCA, the Acalculia subscale was not correlated with the LOTCA because the LOTCA did not have an item comparable with the OT-APST Acalculia. In this research, the item strongly correlated with the DLOTCA Verbal Mathematical Questions (rho= 0,690 Table 4.28).

CHAPTER 6
CONCLUSION

As more people are surviving a stroke these days, it is imperative that occupational therapists find additional ways to improve their patient management while also being time efficient as well. As most therapists have a large case load, they need to be able to identify participants who require further in-depth assessments and this is where a screening tool with validity evidence becomes useful. The Occupational Therapy Adult Perceptual Screening Test (OT-APST) is a screening tool designed to identify visual perceptual problems following stroke or other traumatic brain injuries (Cooke, McKenna et al. 2005). The aim of the study was to determine the convergent validity the OT-APST when compared to two commonly used visual perceptual tools in South Africa. The reference tools used in this study were the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (Appendix B) and Rivermead Perceptual Assessment Battery (Appendix C). These tools were chosen because they are commonly used in South Africa. Since the OT-APST was the primary focus for this study, only the visual perceptual constructs evaluated by the tool were correlated with the items of the DLOTCA and the RPBA.

Previous research on the OT-APST was done by comparing the performance of participants on the OT-APST with the Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) and LOTCA- Geriatric (LOTCA-G) (Cooke DM, McKenna K et al. 2006a). In an independent study by Brown et al. the OT-APST was compared with the Neurobehavioural Cognitive Status Examination (Cognistat) and Developmental Test of Visual Perception- Adolescent and Adult (DTVP-A) (Brown, Mapleston et al. 2011). In Cooke et al.'s study six of the OT-APST subscales correlated with the LOTCA and the LOTCA-G items (Cooke DM, McKenna K et al. 2006a). However, in Brown et al.'s study the OT-APST only two of the OT-APST subscales correlated significantly with the Cognistat and the DTVP-A(Brown, Mapleston et al. 2011).

This current research revealed that when compared to the DLOTCA and the RPAB, six of the seven subscales of the OT-APST which were correlated (the 7th

subscale was not correlated in this study) had high correlations with similar cognitive areas from the DLOTCA. In the comparison of the OT-APST with the RPAB, where the items from the reference tool were not added, the OT-APST subscale often correlated moderately to highly with an appropriate item from the reference tool. While the DLOTCA allows mediation, the OT-APST significantly correlated with the 'Before mediation score' which is consistent with OT-APST being a static tool without mediation. This study then supports the initial research done by Cooke et al. in determining the construct validity of the OT-APST.

Key findings of high correlations between the OT-APST subscales and the DLOTCA and the RPAB include:

- OT-APST Agnosia subscale and the DLOTCA Visual Perception, DLOTCA Spatial Perception, DLOTCA Praxis, DLOTCA Visuomotor Construction, RPAB Colour Matching and RPAB Figure-Ground.
- OT-APST Body Scheme subscale and the DLOTCA Spatial Perception. Insignificant correlations with RPAB items relating to cognitive area
- OT-APST Unilateral Neglect subscale and the DLOTCA Spatial Perception, Visuomotor Construction - Puzzle item; RPAB Copying Shapes and RPAB Copying Words.
- OT-APST Praxis subscale and the RPAB Body Image Self-Identification item.
- OT-APST Constructional skills the DLOTCA Visuomotor Construction,, DLOTCA Visual Perception, DLOTCA Spatial Perception, DLOTCA Praxis, RPAB 3D , RPAB Cube Copying and RPAB Body Image.
- OT-APST Acalculia and the DLOTCA Spatial Perception and DLOTCA Verbal Mathematical Questions.

It is clear that the OT-APST subscales significantly correlated with either one or both the reference tools. This study supports the existing evidence of the convergent validity of the OT-APST when compared to the DLOTCA and RPAB. The OT-APST also proved to be useful in identifying participants with visual

perceptual deficits in a South African sample. Although the Functional Skills subscale was not compared to the DLOTCA or RPAB, it is important to note that this subscale is very useful in determining how functional the patient is given their impairments. This is an added advantage of using the OT-APST.

6.1 Limitations

Patients from Chris Hani Baragwanath Academic Hospital were not included due to language barriers as well as not being medically stable enough to endure the evaluation procedure. This population were mostly Zulu speaking with very little understanding of English. They therefore could not provide consent to participate in the study and could also not be assessed as the tools used were validated in English. Translating the tools from English to local languages was not possible for this study due to time constraints. Bias with regards to a majority of the black non-English speaking population being excluded thus affecting the generalizability of the research results to the larger South African population although the private hospitals provided patients of mixed races. The generalization of results is further compromised by the small sample size of this study (only 32 patients). Therefore, the OT-APST may be cautiously used in South Africa

6.2 Recommendations for further studies

This study needs to be done on a larger sample size which is more representative of the South African population to allow generalizability of the results. The normative data for the African population need be established to tailor the OT-APST to the African population. The OT-APST needs to be translated to native languages and be validated so that a number of patients can benefit from the tool. The OT-APST needs to be available and affordable to the South African therapist as this can hinder the use of such a valuable tool.

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APPENDICES

APPENDIX A: OT-APST

OT-APST OCCUPATIONAL THERAPY ADULT PERCEPTUAL SCREENING

Assessment Form

Date/s of Assessment: _____

Therapist: _____

Client Condition: _____

Visual Screening

Reading glasses worn for testing: Yes / No

Visual Tracking: intact / impaired ***Visual Fields:*** intact / impaired

Visual Acuity: Font size = _____

Visual History: _____

Summary of OT-APST Results

Agnosia (____ / 26) Intact / Impaired

Colour naming ..... / 6
Object name (stapler) ..... / 1
Figure-ground ..... / 5
Shape constancy ..... / 10
Reading (alexia) ..... / 4

Visuospatial Relations

a) Body Scheme (____ / 22) Intact / Impaired

Body parts self ..... / 8
Body parts therapist ..... / 4
Left / Right on self ..... / 4
Directions / position ..... / 6

b) Unilateral Neglect (____ / 13) Intact / Impaired

Clock ..... / 3
House ..... / 4
Hand writing ..... / 1
Reading ..... / 4
Telling the time ..... / 1

Constructional Skills (____ / 53) Intact / Impaired

Graphic construction
Clock ..... / 3
House ..... / 4
2 dimensional construction ..... / 26
3 dimensional construction ..... / 20

Functional Skills (____ / 11) Intact / Impaired

Reading ..... / 4
Writing ..... / 1
Calculations ..... / 4
Telling the time ..... / 1
Stapler hold and use to command ..... / 1

Praxis (____ / 10) Intact / Impaired

Facial gesture
Smile command ..... / 1
Smile copy ..... / 1
Wave right hand
To command ..... / 1
To copy ..... / 1
Wave left hand
To command ..... / 1
To copy ..... / 1
Stapler manipulation
Hold and use to command ..... / 1
Hold and use to copy ..... / 1
Pen use for writing ..... / 1
Handwriting ..... / 1

Acalculia (____ / 4) Intact / Impaired

Calculations ..... / 4

Insight into errors? Yes / No

.....

Time for OT-APST completion .....

Behavioural Observations

.....

.....

.....

.....

OT-APST

APPENDIX B: DLOTCA

DLOTCA

Dynamic Loewenstein Occupational Therapy Cognitive Assessment

Scoring Sheet

Date of test: _____ _____

Tester name: _____

ORIENTATION						
		A	b	c	d	Total / by 4
1.	Orientation for place	0 1 2	0 1 2	0 1 2	0 1 2	
2.	Orientation for time	0 1 2	0 1 2	0 1 2	0 1 2	
Domain score total divided by 2 =_____						

AWARENESS				
3.	Awareness of reason for hospitalization	1	2	3
4a.	Awareness of cognitive disabilities before testing	1	2	3
4b.	Awareness of cognitive disabilities after testing	1	2	3
Note: No domain is calculated; compare 4b to 4a to evaluate change in online awareness				

VISUAL PERCEPTION									
		Static Score				Mediation Score			
						General Intervention	General Feedback	Specific Specific	Structured Category
5. Object identification	Before mediation	1	2	3	4	1	2	3	4
	After mediation	1	2	3	4				
6. Figure-ground	Before mediation	1	2	3	4	1	2	3	4
	After mediation	1	2	3	4	–			
7. Object Constancy	Before mediation	1	2	3	4	1	2	3	4
	After mediation	1	2	3	4				
Domain score before mediation total divided by 3 =_____ After mediation divide by number of items mediated =_____									

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APPENDIX C: RPAB

Rivermead Perceptual Assessment Battery

Score sheet

Sex	:_____
Occupation	:_____
Diagnosis	:_____
Hemisphere Affected	:_____
Date of onset	:_____
Referred by	:_____
Tasks done with	:Right/Left/Both hands□
Premorbid handedness for writing	:Right/Left/Either□
Glasses	: Yes/No□
Estimated premorbid intelligence	:Below average/ Average/ Above average□
Other assessments	:_____
Date of 1st Assessment	:_____
Date of 2nd Assessment	:_____

□ delete as appropriate

Summary

Classification of Tests	Test No.	Task	Score	Acceptable Score (see Table 14 in Manual)
Form constancy	1	Picture Matching		
	2	Object Matching		
	4	Size Recognition		
Colour constancy	3	Colour Matching		
Sequencing	5	Series		
	9	Sequencing-Pictures		
Object completion	6	Animal Halves		
	7	Missing Article		
Figure ground discrimination	8	Figure Ground Discr.		
Body image	10	Body Image		
	16	Body Image-Self Identification		
Inattention	11	R/L Copying Shapes		
	12	R/L Copying Words		
	15	Cancellation		
Spatial awareness	13	3D Copying		
	14	Cube Copying		

Comments on patient's general performance

APPENDIX D

Comparison of OT-ASPT and RPAB

Description	OT-APST	RPAB
Colour naming	Colour naming	colour matching
Object name	Object name-stapler	Object matching
Figure-ground	Figure-ground	figure ground
Shape constancy	Shape constancy	Size recognition, 3D Copying
Reading	Reading	Colour matching, R/L copying of words
Body parts self	Body parts self	Body image self-identification
Body parts therapist	Body parts therapist	Body image SI
Left/right on self	Left/right on self	-
Directions/Positions	Directions/Positions	-
Clock drawing	Clock	-
Unilateral neglect	Clock, house, hand writing, reading, telling time	R/L copying words and shapes, cancellation
Constructional skills	Clock, house, 2D construction, 3D construction	3D copying selection, Cube copying
Calculations	Calculations	-
Writing	Writing	Copying
Praxis	Praxis: facial gesture, wave, stapler manipulation, pen use for writing, handwriting	-

Comparison of the OT-APST and DLOTCA

OT-APST and DLOTCA

Description	OT-APST	DLOTCA
Colour naming	Colour naming	-
Object name	Object name-stapler	5- Object identification
Figure-ground	Figure-ground	6- figure ground
Shape constancy	Shape constancy	? shape constancy
Reading	Reading	-
Body parts self	Body parts self	Directions on client's body/motor imitation
Body parts therapist	Body parts therapist	Motor imitation
Left/right on self	Left/right on self	Directions on clients body
Directions/Positions	Directions/Positions	Spatial relations on a picture
Clock drawing	Clock	Clock drawing
Unilateral neglect	Clock, house, hand writing, reading, telling time	-
Constructional skills	Clock, house, 2D construction, 3D construction	Visuomotor construction: geometric forms, 2D, pegboard, coloured block design, puzzle, clock drawing
Calculations	Calculations	Verbal Mathematical Questions
Writing	Writing	Geometric forms, geometric sequencing
Praxis	Praxis: facial gesture, wave, stapler manipulation, pen use for writing, handwriting	Praxis: motor imitation, utilisation of objects, symbolic action

APPENDIX E

Information sheet

Good Day

My name is Fadzai Razemba. I am an Occupational therapy master's student from the University of Witwatersrand. I am doing a study on whether a test developed in Australia, for identifying people with visual perceptual problems, adequately pinpoints patients who require therapy and those who do not.

Why am I doing this research?

The purpose of this research is to determine whether a new instrument is suitable to identify patients with visual perceptual problems after stroke. If there is a correlation between the OT-APST, then patients with visual perceptual problems will be identified quickly with the new standardised test.

What is required of you the participant?

The research will be done in two or three sessions depending on how much you can manage. The OT-APST requires a maximum of 25 minutes, the LOTCA requires 45 minutes and the Rivermead requires 60 minutes.

There are no physical or potential risks involved in the research. The major advantage of participating in this research is that if you have visual perceptual problems, the problems will be identified quickly and the information will be forwarded to your treating therapist. I cannot guarantee that you will receive benefits from your participation.

Efforts will be made to keep the personal information obtained confidential and you will remain anonymous in the research report and any publications. Personal information may be disclosed if required by law.

You are free to refuse to participate and this will not affect your treatment in any way. If you agree to participate, you may withdraw from the research at any given moment and the decision will not affect your care.

Contact details:

Fadzai Razemba: 0742072909

Ms Anisa Keshav: 011 717 1234 (Secretary: Medical Human Research and Ethics Committee)

For any queries, you may contact the University of Witwatersrand Occupational Therapy department on 011 717 3701.

Informed consent

Title: Convergent validity of the Occupational Therapy Adult Perceptual Screening Test (OT-APST) with two other cognitive-perceptual tests in South Africa

Researcher: Fadzai Razemba

Supervisor: Katherine Gradidge

I .....certify that I have read the information sheet and understand its contents. By signing I confirm that I understand the information and freely give my consent to participate in the research. Any questions have been answered or will be answered by the researcher.

_____

Signature

_____

Date

_____

Witness

APPENDIX F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ms Fadzai Razemba

CLEARANCE CERTIFICATE	**M120631**
PROJECT	Convergent Validity of the Occupational Therapy Adult Perceptual Screening Test with Two Other Cognitive-Perceptual Test in South Africa
INVESTIGATORS	Ms Fadzai Razemba.
DEPARTMENT	Department of Occupational Therapy
DATE CONSIDERED	29/06/2012
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

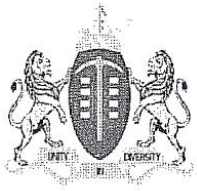
DATE 25/07/2012 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Katherine Gradidge

DECLARATION OF INVESTIGATOR(S)
To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX G



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GAUTENG DEPARTMENT OF HEALTH

RESEARCH PROPOSAL EVALUATION FORM

Researcher Name	Fadzai Razemba
Researcher's contact details	082 435 5750
Institution	University of the Witwatersrand
Research Topic	Convergent validity of the Occupational Therapy adult perceptual screening test with two other cognitive-perceptual tests in South Africa on patients with cerebrovascular accident
Date Received by the Directorate PPR	02/08/2012
Date Received Reviewer	20/08/2012
Final Review Date	20/08/2012
Date Submitted to Director of PPR	20/08/2012
Research Site(s)	Charlotte Maxeke Johannesburg Academic Hospital, Chris Hani Baragwanath Hospital, Life New Kensington Hospital and Netcare Rehabilitation Hospital
Type of research	descriptive

CRITERIA	YES	NO	COMMENTS
1. Is this research project within the scope of the Department of Health key policy priorities/directives?	X		
2. Content of Research:			
▪ Original work	X		
▪ New facts, ideas	X		
▪ Confirmation of uncertain data	X		
▪ Repetition of known data and consequently of limited importance		X	
▪ Insufficient research information		X	
▪ Confusion of topics/questions		X	
3. Is the title of the research project suitable?	X		
4. Are the objectives of the research project adequate?	X		

CRITERIA	YES	NO	COMMENTS
5. Could the objectives be limited to better focus on the project's main objective?		X	
6. Writing style			
▪ The text of the proposal is clear	X		
▪ The nomenclature used is correct	X		
▪ The references used are relevant, comprehensive and accurate	X		
▪ The spelling and grammar are correct	X		
▪ The language needs improvement		X	
▪ The research proposal needs re-styling and re-writing		X	
7. Are the research methods appropriate to the study?	X		
8. Is data collection method in line with the study design?	X		
9. Does the study have ethical approval? If yes, name the ethics committee.	X		
10. Is the definition and measurement of variables consistent with the scope of the proposal?	X		
11. Is the time frame of the proposal adequate to meet the objectives?	X		
12. Is the method of dissemination of the results of the research project stated?		X	It is recommended that the researchers specify how the results will be shared / disseminated
13. Is any possible conflict of interests clarified?	n/a		
14. Are financial implications and financial support transparent?	x		

SUMMARY OF PROPOSAL

Background

The study's focus is to demonstrate the convergent validity of a screening tool by assessing the level of correlation between the results from the new instrument (OT-APST) and results from cognitive- perceptual tests which have good psychometric properties and already being used. The screening tool was designed to identify patients' visual perceptual deficits following a cerebrovascular accident and other brain injuries. The assessment will be done with the participant sitting and manipulating objects or answering questions. Participants will receive the usual treatment but the research may interfere with the usual order of their sessions. The OT-APST (appendix 10) is an occupational therapy screening instrument which was developed for use with adult patients following CVA or other forms acquired brain injuries (12, 13). The tool was developed in response to a need for a comprehensive visual perception screening tool, since available instruments in occupational therapy were not suitable for use as screening tools (12). The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) - appendix 11 (7) is an assessment battery with six subscale areas which include: orientation, visual perception, spatial perception, visuomotor organisations, motor praxis and thinking operations; the LOTCA (appendix 11) was developed to determine the level of functioning for a patient in the different subscales and to plan the occupational therapy treatment accordingly (22). The Rivermead Perceptual Assessment Battery (RPAB) (appendix 12) was developed to assess visual perception in patients after CVA and it may be used to monitor progress (23). Both the LOTCA (appendix 11) and the RPAB (appendix 12) have demonstrated reliability with the LOTCA (appendix

11) reliability ranging from 0.82 to 0.97 (7) while the RPAB (appendix 12) had a $p<0.01$(23). The assessment tools in this research are commonly used assessments in South Africa as well as readily available and the LOTCA is a gold standard instrument.
Both the screening tool and assessment tools used in this research identify the specific level of the problem, and the tools are able to specify exact areas of concern (12). For the LOTCA (appendix 11) and the RPAB (appendix 12), validity was assessed by comparing results with results from psychological tests, such as the Wechsler Adult Intelligence Scale (WAIS), and there was good correlation $p<0.05$ to $p<0.001$for RPAB and $p<0.01$ for the LOTCA (23), (24).

Objectives

- To compare the common subscale areas which test for similar aspects between the OT-APST and two other cognitive-perceptual tools: the Lowenstein Occupational Therapy Cognitive Assessment and Revermead Perceptual Assessment Battery in patients after a CVA.
- To establish whether similar subscales on the OT-APST, Lowenstein Occupational Therapy Cognitive Assessment and Rivermead Perceptual Assessment Battery give similar results on the same patient after a CVA.
- To determine which aspects of the screening tool would be suitable for use on patients after a CVA.

METHODS

This is a quantitative cross sectional study which is correlative and comparative in nature. Data from the screening tool and assessments will be ordinal and therefore non parametric. The research is similar to a study done by Dr Brown, whereby 32 adult patients were screened within a week of admission into a rehabilitation unit. Dr Brown compared the OT-APST with the Neurobehavioural Cognitive Status Examination (Cogniststst) and Developmental Test for Visual Perception – Adolescent and Adult (DTVP-A), but this study will be comparing the results from the OT-APST with results from LOTCA and the RPAB which are the assessment batteries commonly used in South Africa. Convenient sampling will be conducted to select 50 patients presenting with CVA at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), the Chris Hani Baragwanath Hospital, Life Kensington Hospital and Netcare Rehabilitation Hospital from October 2012 to March 2013, if they meet the inclusion criteria.

The instruments to be used are the OT-APST (appendix 10), LOTCA (appendix 11) and the RPAB (appendix 12). The tools to be used are standardized perceptual assessment tools. All the tools have manuals which provide directions on scoring and administration of the tools.

The OT-APST (appendix 10) has a total of 25 items under 7 subtests with several of the items contributing to more than one subtest. The subscale areas include: agonsia, visuospatial relations including body scheme and unilateral neglect, constructional skill, apraxia, acalculia and functional skills (12). It takes approximately 20 to 25 minutes to administer, and it should be administered in its entirety to maintain its psychometric properties. It requires simple verbal or motor responses, which are not dependent on hand dominance, using one hand for manipulation or writing (12). Interpretation of results requires comparing the scores to normative data given and the results will indicate whether there is need for more detailed assessments as well as to guide treatment planning (12). The comparison will determine intact or impaired performance. There is a need to assess the impact of the perceptual problems on functional performance for patients with results indicating impairment (12). The results from the tool are scored after comparing with normative data and for each item are categorized into either impaired or intact (13).

The LOTCA (appendix 11) and the RPAB (appendix 12) will be reference tools to assess validity. The LOTCA (appendix 11) was developed in Israel at Loewenstein Rehabilitation Hospital (7). The main purpose was to assess the cognitive abilities of patients following head injuries (7). The LOTCA (appendix 11) second edition has 26 items grouped into six subtests including: orientation, visual perception, spatial perception, visuomotor organizations, motor praxis and thinking operations (22). It takes approximately 45 minutes to administer and may be administered in 2 sessions if necessary (7), (22). Each item is scored on a scale of 1 (poor) to 4 (good), with the exception of the orientation and thinking operations items.

RPAB (appendix 12) was developed to assess visual perception in patients after CVA and it may be used to monitor progress (23). It has a total of 16 items grouped into eight categories: colour matching, object matching, figure ground, inattention, body image,

spatial awareness, form constancy and sequencing. The tool takes about 45 to 60 minutes to administer on normal subjects, and can be administered in two sessions (23). Results from the RPAB (appendix 12) are compared to given normative data.

REVIEWER'S FINAL CONCLUSION

The proposed study will demonstrate the convergent validity of a screening tool by assessing the level of correlation between the OT-APST, and the results from cognitive perceptual tests which have good psychometric properties and already being used. If there is correlation then patients with visual perceptual problems will be identified with a standardized test. The study will propose a technique that will quickly identify patients with visual perceptual problems and is recommended for approval.

Reviewed and Recommended by

Dr Bridget Ikalafeng, DD: Research and Epidemiology

Date: 31/08/2012

Approved

S. le Roux, Director: PPR

Date: 6/09/2012

APPENDIX H

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Office of the CEO
Enquiries:
Ms. L. Mngomezulu
(011): 488-3793
(011) 488-3753
10th August 2012

Ms. Fadzai Rezemba
Occupational Therapy Department
University of Witwatersrand

Dear Ms. Rezemba

RE: "Convergent validity of the Occupational Therapy Adult perceptual screening test with two other cognitive-perceptual test in South Africa"

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. T.E. Selebano
Chief Executive Officer

APPENDIX I

Life Rehabilitation

National Rehabilitation office
Oxford Manor, 21 Chaplin Road, Illovo, 2196
Private Bag X13, Northlands, 2116, South Africa
Telephone +27 11 219 9620
Facsimile +27 86 686 0441
www.rehab.co.za

14 August 2012

Fadzai Razemba

Request for permission to conduct research

Dear Fadzai

Many thanks for the request for permission to conduct research at our Life Rehabilitation Units on the topic: Convergent validity of the Occupational Therapy Adult Perceptual Screening Test with two other cognitive-perceptual tests in South Africa on patients with cerebrovascular accident. Life Rehabilitation supports the development of the field of rehabilitation through evidence-based research and we have a number of ongoing research projects in our units.

I hereby grant permission to you to access patients who sustained cerebrovascular accidents in order to conduct your research at Life New Kensington Rehabilitation Unit. As we value patient confidentiality and their right to choose, permission is granted under the following conditions:

- Patients must provide consent to participate in the research project. If the patient is in any way unable to provide consent, the appropriate family member must participate in the decision-making process
- No patient may be identified, either by name or by the unit where the patient received his/her rehabilitation.
- Access to patient documentation must be controlled and supervised
- The data gathered can only be used for research purposes and no information obtained in our units may be used by third parties

Access to the units is dependent upon permission by the relevant managers to limit disruption to the unit routine and patients' rehabilitation programmes. Please liaise with the therapy manager, Danny Joelson to arrange visits.

I wish you success with your research, and look forward to the results. We would appreciate a copy of your research upon completion.

Sincerely,

NStrydom

Nina Strydom
Support Specialist
Clinical Products
Life Healthcare
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Mobile: + 27 84 566 1281
Email: nina.strydom@lifehealthcare.co.za
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APPENDIX J

2

Care Cure Clinic
Unit 6, Medi Village
9 Joubert Street
Vereeniging
1900

Tel (016) 422 8157
Fax 086 511 5759
Email: rehab@physicalrehab.co.za
Website: www.physicalrehab.co.za

RITA HENN & PARTNERS INC
PHYSICAL REHABILITATION THERAPISTS

PostNet Suite 224
Private bag X 9
Melville
Johannesburg
2109

Pr: 050 000 0206822
Reg No. 2003/024744/21
Vat reg no: 4040209365

01/11/12

To Whom it May Concern

Re: Fadzai Research at Rita Henn and Partners

Please note that on behalf of Rita Henn and Partners we are pleased to assist you with your MSc data collection. However it is essential that the patient's normal rehabilitation times are not compromised. Can you also please ensure confidentiality and that you receive informed consent from every subject.

Yours Truly

Dr. M Knox
Research Coordinator
Rita Henn and Partners Incorporated

APPENDIX K

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oColour naming	oObject Naming	oFigure ground	oShape constancy
dB Orientation	0.617460	0.418183	0.441834	0.397562
dB Object ID	0.748124	0.357830	0.584238	0.131809
dM Object				
dB Figure ground	0.413376	0.236433	0.356938	0.314386
dM Figure ground				
dB Object Con	0.361863	-0.035875	0.487435	0.339179
dM Object Con	0.039375	-0.097590	0.228615	0.334122
dB Directions Cl	0.622573	0.462910	0.120491	0.373198
dM Directions				
dB SR cl and Ob	0.162347	0.449712	0.173735	0.158356
dM SR cl and ob				
dB SR pic	0.691930	0.365115	0.554662	0.226240
dM SR pic				
dB Motor Imitation	0.242199	0.138527	0.411052	0.688938
dM Motor	-0.082169	-0.067884	0.413469	0.232418
dB Utilisation	-0.156390	0.185379	0.071062	0.275789
dM Utilisation				
dB Symbolic actions	0.359798	0.260666	0.229257	0.472726
dM Symbolic				

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oColour naming	oObject Naming	oFigure ground	oShape constancy
dB Copy Geometric	0.193699	0.218218	0.252191	0.437304
dM Copy geo	-0.068199	0.169031	0.105593	0.095568
dB 2D construction	0.423590	0.325177	0.480273	0.469549
dM 2D	-0.156390	-0.219084	0.281617	0.258850
dB Pegboard	0.466845	0.155427	0.520533	0.344453
dM Pegboard	0.048224	-0.119523	0.373327	0.473036
dB Coloured block	0.441438	0.283654	0.487293	0.477304
dM Coloured	0.300775	0.095572	0.611962	0.153100
dB Plain	0.387303	0.152511	0.472161	0.593730
dM Plain	-0.040492	-0.186381	0.597830	0.234622
dB Puzzle	0.378910	0.265789	0.362514	0.494789
dM Puzzle	0.066360	-0.104664	0.618806	0.241869
dB Clock	0.126121	0.294725	0.034870	0.674108
dM Clock	-0.096449	0.119523	-0.018666	0.341637
dB Categorization	0.197329	0.207235	0.343066	0.546524
dM Categorisation	0.246506	0.294166	0.583097	0.363197
dB U ROC	0.429103	0.294166	0.243841	0.425744
dM UROC	0.319998	0.191440	0.439926	0.402884
dB Pic s1	0.285351	0.210259	0.343296	0.528946
dM Pic s1	0.169989	0.050558	0.365839	0.123338

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oColour naming	oObject Naming	oFigure ground	oShape constancy
dB Pic s2	0.361620	0.081479	0.566963	0.576406
dM Pic s2	0.225599	0.186381	0.441096	0.269748
dB Geo s1	0.324341	0.078811	0.494790	0.548072
dM Geo s1	-0.044394	0.022006	0.429594	0.353211
dB Geo s2	0.234411	0.058940	0.387921	0.578938
dM Geo s2	-0.021732	-0.075408	0.405459	0.339387
dB V. Maths	0.336530	0.194879	0.332350	0.312182
dM V.Maths	0.385631	0.094528	0.605272	0.183097
dB S ROC	0.271765	0.039621	0.278452	0.352200
dM SROC	-0.109175	-0.090196	0.391599	0.095759

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
dB Orientation	0.615152	0.428704	0.307238	0.426679	0.408001
dB Object ID	0.557248	0.320925	0.222053	0.316978	0.285008
dM Object					
dB Figure ground	0.298205	0.189342	0.026458	0.300501	0.239856
dM Figure ground					

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
dB Object Con	0.249273	0.375929	0.485756	0.264457	0.539295
dM Object Con	0.355833	-0.094781	-0.076445	-0.074421	0.171005
dB Directions Cl	0.562621	0.859735	0.707950	0.823688	0.839608
dM Directions					
dB SR cl and Ob	0.411971	0.354496	0.384054	0.158436	0.233568
dM SR cl and ob					
dB SR pic	0.477252	0.585354	0.513815	0.525927	0.609171
dM SR pic					
dB Motor Imitation	0.416150	0.498034	0.656237	0.254316	0.396046
dM Motor	0.471690	-0.065931	-0.053175	-0.051768	-0.081388
dB Utilisation	0.186663	-0.074946	-0.050918	-0.167070	-0.262665
dM Utilisation					
dB Symbolic actions	0.182160	0.432691	0.597204	0.161581	0.393495
dM Symbolic					
dB Copy Geometric	0.645541	0.390410	0.288148	0.403082	0.293827
dM Copy geo	0.441890	0.155525	0.037830	0.200512	0.031178
dB 2D construction	0.573336	0.384205	0.371162	0.285763	0.321316
dM 2D	0.149562	-0.212778	-0.171614	-0.167070	-0.163194
dB Pegboard	0.421771	0.165077	0.214511	0.071701	0.339244
dM Pegboard	0.411136	0.061096	0.133750	0.020255	0.198414

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
dB Coloured block	0.398651	0.279633	0.267539	0.209444	0.302709
dM Coloured	0.303766	0.217886	0.280206	0.124710	0.283816
dB Plain	0.495601	0.261849	0.272060	0.195358	0.242420
dM Plain	0.285050	-0.181017	-0.145997	-0.142132	-0.223457
dB Puzzle	0.508331	0.312483	0.263718	0.280759	0.377491
dM Puzzle	0.373398	-0.095537	-0.015059	-0.130492	-0.136516
dB Clock	0.537621	0.366591	0.374781	0.236861	0.366532
dM Clock	0.156232	-0.103863	-0.013375	-0.232930	-0.165345
dB Categorization	0.544618	0.401270	0.392380	0.320986	0.254576
dM Categorisation	0.259974	0.313459	0.453258	0.055602	0.269208
dB U ROC	0.546413	0.544794	0.473515	0.500422	0.452853
dM UROC	0.265288	0.431972	0.541690	0.220143	0.390944
dB Pic s1	0.474717	0.548136	0.575384	0.419478	0.477728
dM Pic s1	-0.073042	0.062886	0.190472	-0.075681	0.035747
dB Pic s2	0.549956	0.404924	0.452848	0.307605	0.364866
dM Pic s2	0.504016	0.251371	0.145997	0.297626	0.181146
dB Geo s1	0.601832	0.311810	0.294562	0.289817	0.391038
dM Geo s1	0.591945	0.160857	0.125589	0.173408	-0.030443
dB Geo s2	0.558992	0.308600	0.294918	0.290372	0.337794
dM Geo s2	0.559543	0.111784	0.075946	0.161563	-0.010929

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
dB V. Maths	0.482113	0.380532	0.348049	0.338835	0.394681
dM V.Maths	0.337441	0.280789	0.299709	0.214477	0.237318
dB S ROC	0.357081	0.168101	0.243857	0.083930	0.222900
dM SROC	0.239520	-0.168746	-0.119101	-0.178834	-0.281161

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oClock	oHouse	oHandwriting	oTelling time	o2D construction
dB Orientation	0.498048	0.542879	0.220381	0.281235	0.533379
dB Object ID	0.306048	0.319460	0.081236	0.337923	0.481430
dM Object					
dB Figure ground	0.352737	0.383364	0.253045	-0.080716	0.403250
dM Figure ground					
dB Object Con	0.298194	0.576204	0.038395	-0.026244	0.554269
dM Object Con	-0.044570	0.564280	-0.174078	-0.071392	0.413875
dB Directions Cl	0.380546	0.212430	0.385337	0.519252	0.561736
dM Directions					
dB SR cl and Ob	0.317809	0.049964	-0.042220	0.342840	0.306468
dM SR cl and ob					

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oClock	oHouse	oHandwriting	oTelling time	o2D construction
dB SR pic	0.271854	0.350335	0.240776	0.280051	0.516699
dM SR pic					
dB Motor Imitation	0.257283	0.614512	0.280047	0.141876	0.617526
dM Motor	-0.031003	0.691579	-0.121090	-0.049661	0.315071
dB Utilisation	0.294014	0.153127	-0.198403	0.076437	0.348923
dM Utilisation					
dB Symbolic actions	0.439851	0.285828	0.230036	0.254923	0.333478
dM Symbolic					
dB Copy Geometric	0.259120	0.596836	0.015570	0.261806	0.703781
dM Copy geo	-0.030879	0.341301	-0.120605	-0.049462	0.342567
dB 2D construction	0.352183	0.630151	0.049718	0.216135	0.683313
dM 2D	-0.050798	0.450099	-0.006012	-0.239174	0.220738
dB Pegboard	0.399091	0.572188	-0.117059	0.194558	0.765021
dM Pegboard	0.196513	0.636250	-0.170561	0.174874	0.607073
dB Coloured block	0.536695	0.554148	0.014456	0.243081	0.673722
dM Coloured	0.267130	0.598226	-0.047734	0.159409	0.535881
dB Plain	0.495764	0.508025	-0.060810	0.374086	0.805039
dM Plain	0.166315	0.509235	-0.332460	-0.002098	0.423107
dB Puzzle	0.593990	0.525287	-0.006321	0.329249	0.707353
dM Puzzle	0.159792	0.660076	-0.144023	-0.164073	0.376538

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oClock	oHouse	oHandwriting	oTelling time	o2D construction
dB Clock	0.356494	0.315582	0.015931	0.361958	0.614623
dM Clock	0.098257	0.098728	-0.042640	0.227337	0.222793
dB Categorization	0.609520	0.597230	0.298685	0.277737	0.711501
dM Categorisation	0.382374	0.641735	-0.056509	0.188712	0.566448
dB U ROC	0.531190	0.259602	0.201816	0.533028	0.614006
dM UROC	0.447152	0.459340	0.185377	0.204070	0.627819
dB Pic s1	0.515054	0.496475	-0.061372	0.511787	0.753486
dM Pic s1	0.294014	0.202622	-0.198403	0.234243	0.328683
dB Pic s2	0.539987	0.552551	0.093663	0.398698	0.774341
dM Pic s2	0.378464	0.543447	-0.076722	0.136347	0.684613
dB Geo s1	0.398809	0.464377	0.118088	0.269822	0.677736
dM Geo s1	0.371860	0.527144	-0.117760	0.235038	0.638968
dB Geo s2	0.537599	0.431990	0.033043	0.348638	0.655928
dM Geo s2	0.390643	0.467661	-0.134511	0.171800	0.636778
dB V. Maths	0.453557	0.235380	0.169638	0.142564	0.409287
dM V.Maths	0.411568	0.085794	-0.071193	0.315025	0.486294
dB S ROC	0.481338	0.207278	0.014135	0.399995	0.490220
dM SROC	0.156535	0.375831	-0.315342	-0.171557	0.373492

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	o3D construction	oCalculations	oStapler use	oFacialgesture command
dB Orientation	0.650515	0.622213	0.118536	0.260134
dB Object ID	0.529860	0.527649	-0.077290	0.156864
dM Object				
dB Figure ground	0.437152	0.356260	0.187251	0.514167
dM Figure ground				
dB Object Con	0.201098	0.314800	-0.017047	0.132289
dM Object Con	0.455393	-0.077850	-0.046374	-0.083045
dB Directions Cl	0.321527	0.738549	-0.073324	0.218844
dM Directions				
dB SR cl and Ob	0.382751	0.560147	-0.101226	-0.073852
dM SR cl and ob				
dB SR pic	0.475704	0.609000	-0.120924	0.185164
dM SR pic				
dB Motor Imitation	0.294074	0.356076	0.021942	0.039294
dM Motor	0.603666	0.018051	-0.032258	-0.057767
dB Utilisation	0.428815	0.345056	0.408418	0.119508
dM Utilisation				
dB Symbolic actions	0.142936	0.397638	-0.084750	0.097288
dM Symbolic				
dB Copy Geometric	0.713443	0.475812	0.103695	0.284733

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	o3D construction	oCalculations	oStapler use	oFacialgesture command
dM Copy geo	0.545686	0.179787	-0.160644	0.287678
dB 2D construction	0.707576	0.585507	0.225160	0.318880
dM 2D	0.428815	-0.120994	-0.104107	0.425448
dB Pegboard	0.685749	0.399516	0.073857	0.289018
dM Pegboard	0.512139	0.095346	-0.113592	0.067806
dB Coloured block	0.633873	0.614183	0.250324	0.356322
dM Coloured	0.442612	0.299879	-0.245242	0.254830
dB Plain	0.575290	0.493803	0.242994	0.190855
dM Plain	0.553310	0.019062	-0.088567	0.231805
dB Puzzle	0.742084	0.626655	0.294701	0.286490
dM Puzzle	0.562126	0.186866	0.120786	0.080583
dB Clock	0.604168	0.491592	0.207954	0.048133
dM Clock	0.326225	0.000000	0.056796	-0.169516
dB Categorization	0.494590	0.562076	0.256038	0.232781
dM Categorisation	0.438969	0.403139	-0.118280	-0.006419
dB U ROC	0.433657	0.667887	0.139785	0.147627
dM UROC	0.185409	0.414515	-0.116962	0.038788
dB Pic s1	0.401100	0.675998	0.099913	0.092172
dM Pic s1	0.159755	0.165806	-0.104107	0.119508
dB Pic s2	0.380743	0.479057	0.038718	0.151511

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	o3D construction	oCalculations	oStapler use	oFacialgesture command
dM Pic s2	0.564250	0.377420	-0.129444	0.549012
dB Geo s1	0.599986	0.515530	0.127331	0.228022
dM Geo s1	0.602567	0.298429	-0.115027	0.293378
dB Geo s2	0.565150	0.539588	0.124035	0.145691
dM Geo s2	0.533993	0.295047	-0.117738	0.375852
dB V. Maths	0.397382	0.677804	0.092605	0.165835
dM V.Maths	0.185257	0.466406	-0.114792	0.175775
dB S ROC	0.429082	0.368748	0.018828	0.123627
dM SROC	0.475951	0.100732	-0.111437	0.291664

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oFacial gesture copy	oWave to command	oWavecopy	oInsight
dB Orientation	-0.051260			-0.282318
dB Object ID	-0.111111			-0.113183
dM Object				
dB Figure ground	0.269191			-0.039173
dM Figure ground				

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oFacial gesture copy	oWave to command	oWavecopy	oInsight
dB Object Con	0.171550			-0.005944
dM Object Con	-0.066667			-0.016169
dB Directions Cl	-0.105409			-0.127827
dM Directions				
dB SR cl and Ob	-0.145521			-0.286275
dM SR cl and ob				
dB SR pic	-0.052907			-0.012832
dM SR pic				
dB Motor Imitation	0.157720			-0.053554
dM Motor	-0.046374			-0.191204
dB Utilisation	0.218738			-0.259674
dM Utilisation				
dB Symbolic actions	0.178068			-0.211394
dM Symbolic				
dB Copy Geometric	0.149071			-0.368782
dM Copy geo	0.230940			-0.168034
dB 2D construction	0.222138			-0.438708
dM 2D	0.587138			-0.170324
dB Pegboard	0.294935			-0.203152
dM Pegboard	0.163299			-0.039606

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oFacial gesture copy	oWave to command	oWavecopy	oInsight
dB Coloured block	0.249136			-0.288695
dM Coloured	0.274211			-0.237521
dB Plain	0.153213			-0.129315
dM Plain	0.342791			0.007126
dB Puzzle	0.133150			-0.366973
dM Puzzle	0.173641			-0.156070
dB Clock	0.006101			-0.282628
dM Clock	-0.081650			-0.059409
dB Categorization	0.186871			-0.372196
dM Categorisation	0.077290			-0.101226
dB U ROC	-0.046374			-0.191204
dM UROC	0.130778			0.031718
dB Pic s1	0.039173			-0.269191
dM Pic s1	0.218738			0.008377
dB Pic s2	0.154613			-0.298493
dM Pic s2	0.440732			-0.311178
dB Geo s1	0.183050			-0.206311
dM Geo s1	0.315691			-0.215115
dB Geo s2	0.086280			-0.202283
dM Geo s2	0.419469			-0.183839

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oFacial gesture copy	oWave to command	oWavecopy	oInsight
dB V. Maths	0.047926			-0.401665
dM V.Maths	0.179374			-0.012181
dB S ROC	0.135333			-0.361054
dM SROC	0.431311			0.008966

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oColour naming	oObject Naming	oFigure ground	oShape constancy
rPicture matching	-0.116279	-0.172917	0.225043	0.360282
rObject matching	-0.082169	-0.067884	0.413469	0.232418
rColour	0.557165	0.234641	0.771944	0.381678
rSize	-0.082169	-0.067884	0.413469	0.232418
rSeries	-0.003749	-0.027872	0.239411	0.426942
rAnimal Halves	-0.116860	-0.096545	0.588033	0.164189
rMissing article	0.012792	-0.073980	0.622250	0.394039
rFigrue-ground	0.013980	-0.034648	0.275966	0.479942

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oColour naming	oObject Naming	oFigure ground	oShape constancy
rSequencing	0.118388	0.077216	0.417246	0.500114
rBody Image	0.406245	0.237501	0.438305	0.566223
r3D	0.231929	0.121090	0.441477	0.637457
rCube copying	0.364170	0.174586	0.427064	0.348665
rBody Image SI	0.068004	0.074160	0.255855	0.339034

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
rPicture matching	0.503600	0.162047	0.174150	0.180703	0.047842
rObject matching	0.471690	-0.065931	-0.053175	-0.051768	-0.081388
rColour	0.558635	0.570801	0.548818	0.486610	0.457274
rSize	0.471690	-0.065931	-0.053175	-0.051768	-0.081388
rSeries	0.347070	-0.110655	-0.071737	-0.134615	0.007712
rAnimal Halves	0.306477	-0.093766	-0.075626	-0.073624	-0.115750
rMissing article	0.473327	0.295506	0.329961	0.251634	0.184216
rFigrue-ground	0.574460	0.270976	0.267528	0.267156	0.175748
rSequencing	0.389914	0.144461	0.184912	0.069352	0.195122
rBody Image	0.428270	0.445427	0.464538	0.323966	0.509334

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oReading	oBodyParts self	oBP therapist	oLT/Rt self	oDirection/position
r3D	0.546658	0.274696	0.294216	0.194237	0.309483
rCube copying	0.502779	0.273229	0.228393	0.262181	0.291895
rBody Image SI	0.442015	-0.032739	-0.050547	-0.025706	0.078964

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oClock	oHouse	oHandwriting	oTelling time	o2D construction
rPicture matching	0.047384	0.449660	-0.143940	0.278295	0.548739
rObject matching	-0.031003	0.691579	-0.121090	-0.049661	0.315071
rColour	0.416353	0.484723	0.133111	0.360751	0.654885
rSize	-0.031003	0.691579	-0.121090	-0.049661	0.315071
rSeries	0.163786	0.515889	-0.314879	0.001359	0.592421
rAnimal Halves	0.076847	0.618997	-0.172213	-0.070628	0.299016
rMissing article	0.236510	0.683838	0.079178	-0.066490	0.575002
rFigrue-ground	0.199382	0.721858	0.284297	-0.086179	0.509307
rSequencing	0.362526	0.562700	-0.214867	0.074564	0.774529
rBody Image	0.467789	0.594068	0.242254	0.060199	0.768113
r3D	0.515016	0.515956	0.041213	0.121167	0.681637
rCube copying	0.329294	0.478204	-0.068086	0.274403	0.737169

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)				
	oClock	oHouse	oHandwriting	oTelling time	o2D construction
rBody Image SI	0.024017	0.640424	-0.060129	-0.119355	0.456036

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	o3D construction	oCalculations	oStapler use	oFacialgesture command
rPicture matching	0.400912	0.168594	0.136948	-0.147146
rObject matching	0.603666	0.018051	-0.032258	-0.057767
rColour	0.364525	0.575857	-0.093221	0.007638
rSize	0.603666	0.018051	-0.032258	-0.057767
rSeries	0.618686	0.224815	0.339947	0.102779
rAnimal Halves	0.508804	0.025672	-0.045877	-0.082156
rMissing article	0.377477	0.222011	-0.075331	0.056959
rFigrue-ground	0.442334	0.156624	0.049393	0.245701
rSequencing	0.622289	0.439393	0.330231	0.240929
rBody Image	0.403588	0.406494	-0.001590	0.331147
r3D	0.460402	0.406002	0.142199	0.077776
rCube copying	0.582810	0.533557	0.188426	0.367821
rBody Image SI	0.755635	0.123697	0.086499	0.277291

Variable	Correlations (Raw research data all) Marked correlations are significant at p < .05000 N=32 (Case wise deletion of missing data)			
	oFacial gesture copy	oWave to command	oWavecopy	oInsight
rPicture matching	-0.118125			-0.028649
rObject matching	-0.046374			-0.191204
rColour	-0.134013			0.059270
rSize	-0.046374			-0.191204
rSeries	0.184057			-0.152393
rAnimal Halves	-0.065953			-0.052558
rMissing article	0.122735			0.113817
rFigrue-ground	0.260360			-0.258326
rSequencing	0.305942			-0.130493
rBody Image	0.326773			-0.009422
r3D	0.082721			-0.101697
rCube copying	0.276107			-0.232280
rBody Image SI	0.271728			-0.273668