CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

In Chapter 5, the results of the matched-pair randomised controlled trial are discussed in relation to the literature. This study was based on the limitations indicated in the literature as well as on observations by the researcher in clinical practice. The results in this chapter are discussed in logical sequence based on the aims and objectives of the study.

5.2 Comparison between the demographical data of the participants in Group 1 and Group 2

No statistical difference in the demographical data between the groups was found at baseline. It can be concluded that the two groups were comparable with each other regarding age, gender, race, side of the body that was affected post-stroke and dominant side prior to the stroke at the beginning of the study. No statistical difference between the demographical data regarding the residential areas, access to basic services and level of education between the groups was found at baseline. Based on the interpretation, it can be concluded that the two groups were also comparable with each other regarding home environment, socio-economic status and level of education at the beginning of the study and the demographical data. These factors were therefore not expected to have any influence on the outcome of the intervention(s) on the dependent variables.

No statistical difference between the the participants in the two groups' level of functional activity was found at baseline. It can also be concluded that the two groups were comparable with each other regarding their level of functional activity, specifically their motor function at the beginning of the study. Participants' functional activity level, specifically their residual motor function prior to the intervention, was therefore not expected to have any influence on the outcome of the intervention(s) on the dependent variables.

5.3. The effect of the intervention(s) on body impairment level, functional activity and participation levels

5.3.1. The effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's oculomotor function.

The objective related to the first aim was to determine the effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's oculomotor function measured with the King-Devick Test © that consisted of Subtest 1, Subtest 2 and Subtest 3. In each subtest scores taken included (i) the time taken to complete the test (the time indicated the speed with which the test was completed); and (ii) the average errors made during the completion of the subtests on a weekly basis during the intervention period of four (4) weeks as well as eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated.

In this study, the King-Devick Test © was used to assess residual oculomotor functions and oculomotor visual performance for eye movements during reading (Markowitz, 2006; Chaikin, 2007) over the intervention period of four (4) weeks and to record changes in oculomotor visual performance over time. Participants in Group 1 and Group 2 presented with the following impairments at baseline: (1) decreased residual oculomotor function; and (2) poor oculomotor visual performance during reading.

After the four-week intervention period, participants in Group 1 presented with improved (1) oculomotor function; and (2) oculomotor visual performance during reading as assessed on the King-Devick Subtest 3 compared to participants in Group 2 post-intervention. From the literature summarised in paragraph 2.3 it is clear that oculomotor function have an effect on body impairment, functional activity and participation level. The functional activities that theoretically should improve when visual efficiency improves are personal-hygiene and self-care activities; dressing; walking up and down stairs; walking over uneven surfaces; walking through an aisle; communication; finding objects and reading (Maddock et al, 1981; Schulmann et al, 1987; Zoltan, 1996; Kerkhoff, 2000; Leigh & Kennard, 2004; Chaikin, 2007; Shumway-Cook & Woollacott, 2007; Spering & Gegenfurtner, 2008; Schuett et al, 2009). The result of the change in oculomotor function was compared to the functional ability of participants from Group 1 that received visual scanning exercises integrated with task-specific activities and participants from Group 2 that received task-specific activities alone.

5.3.2. The effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's functional ability.

The second objective related to the first aim was to determine the effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's functional ability measured with the Barthel Index on a weekly basis during the intervention period of four (4) weeks as well as eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated. The result of the change in oculomotor function was compared to the functional activities that are part of the Barthel Index. The activities that are included in the Barthel Index correspond with the activities listed above from the literature.

The interpretation of the Barthel Index at baseline implies that participants in both groups presented with a severe dependence in the performance of ADL. The level of functional performance in ADL of participants in Group 1 improved more during the intervention period compared to participants in Group 2's level of functional performance in ADL whom improved **minimally** over the intervention period. The interpretation of the BI post-intervention implies that participants from Group 2 continued to present with a **severe dependence** in the performance of ADL after four

(4) weeks of intervention. Participants from Group 1 presented with a moderate level of dependence post-intervention.

The decreased oculomotor function and poor oculomotor visual performance during reading noted in participants in Group 2 were associated with a severe dependence in the performance of ADL after the intervention period. The improved oculomotor function and oculomotor visual performance during reading noted in participants in Group 1 were associated with a significantly higher level of functional performance in ADL compared to participants from Group 2 after the four (4) week intervention period. Greater improvement in functional ability was noted over a shorter period of time in participants from Group 1 compared to participants from Group 2.

The results of this study are supported by findings of the previously reviewed literature (Table 2.2.) in the sense that:

(1) Impaired oculomotor function is associated with impairment of postural stability and postural orientation that affects an individual's ability to perform activities of daily living and participation in everyday life situations.

(2) The effect of saccadic eye movement training with visual scanning exercises as an intervention has a statistically significant effect on the oculomotor function of participants that presented with visual perceptual disorders post stroke. Intensive saccadic eye movement training can re-train and strengthen a patient's oculomotor strategies and visual efficiency processes.

(3) The significantly improved oculomotor function improved participants in Group 1's ability to use vision in everyday life with associated improvements in functional ability. The outcome of this study is in line with the outcome in studies listed in Table 2.2.

5.3.3. The effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's perceptual processing and cognitive functioning.

The third objective related to the first aim was to determine the effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's **perceptual processing** and **cognitive functioning** measured with the **Star Cancellation Test** and **Mini-Mental State Examination** on a weekly basis during the intervention period of four (4) weeks as well as eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated.

Based on the literature reviewed in Chapter 2, that the presence of decreased oculomotor function, visual efficiency processes and saccadic eye movements are associated with visual perceptual dysfunction and decreased cognitive functioning which leads to substantial functional disability during daily life activities (Kerkhoff, 2000; Nelles et al, 2009). Perceptual impairments and impairment of cognitive function are a significant cause of disability following a stroke. Impairments of the perceptual system can adversely affect a patient's ability to safely and efficiently mobilise in and around the house as well as at work and in the community. Perceptual impairments also affect the patient's ability to perform most tasks in the work environment, reading and enjoyment of many recreational activities and as such severely affect a stroke survivor's overall quality of life (Martin & Huxlin, 2010).

Cognitive dysfunction may result in reduced efficiency, speed and persistence of functioning and decreased effectiveness in the performance of routine ADL. Cognitive impairment also causes failure to adapt to novel or problematic situations. Stroke patients with cognitive impairments present with extensive functional disability at discharge from acute hospital settings, increased length of stay in rehabilitation facilities, increased hospital resource use, and increased duration of therapy input (Kalra, 1997; Carter, 1983; Chaikin, 2007; Martin & Huxlin, 2010).

The presence of USN (unilateral spatial inattention), visual-spatial disorders and cognitive functioning in participants in Group 1 and Group 2 were assessed weekly by the Star Cancellation Test and Mini-Mental State Examination (MMSE) based on age and educational norm during the four-week intervention period. Based on the interpretation of the Star Cancellation Test, the USN and perceptual processing noted in participants in Group 2 were better than participants in Group 1 at baseline. Participants from Group 1 demonstrated a significant improvement in the USN and perceptual processing in the near extrapersonal space over the four-week intervention period. The USN noted prior to the intervention period was absent in participants of Group 1 post-intervention. The USN noted in participants from Group

2 at baseline **increased** over the four (4) week intervention period. Participants of Group 2 **continued to present** with USN in the near extrapersonal space post-intervention. After the four-week intervention period, participants in Group 1 presented with (1) decreased USN and; (2) better perceptual processing as assessed on the Star Cancellation Test compared to participants in Group 2 post-intervention.

With regard to cognitive functioning assessed by the Mini-Mental State Examination (MMSE) based on age and educational norm, participants in both groups suffered from mild cognitive impairment at the beginning of the study. A tendency towards improvement of cognitive functioning in participants in Group 1 and Group 2 over the four-week intervention period was noted. However, based on the interpretation of the Mini-Mental State Examination (MMSE) based on age and educational norm more (two thirds) participants in Group 1's cognitive functioning improved than participants in Group 2 (one third) after the four-week intervention period.

From the literature summarised in paragraph 2.4 it is clear that the functional activities that theoretically should improve when perceptual processing and cognitive functioning improve are; (1) hygiene and self-care activities; (2) dressing; (3) eating; (4) kitchen activities; (5) walking up and down stairs; (6) walking over uneven surfaces; (7) walking through an aisle; (8) communication; (9) finding objects; (10) writing; (11) reading; (12) driving; (13) recreational activities and hobbies; and (14) social interactions

The result of the change in perceptual processing and cognitive functioning is compared to the functional activities tested on the Barthel Index. The activities that were included in the Barthel Index correspond with the activities listed above from the literature. As the retraining of visual scanning through saccadic eye movement training in the treatment of visual-perceptual dysfunction and cognitive impairment is based on oculomotor strategies and visual efficiency processes, the results of the King-Devick Subtest 3 also need to be highlighted. Perceptual processing, cognitive function and associated functional ability, oculomotor function and visual efficiency processes of participants in Group 1 and Group 2, were assessed weekly by the Star Cancellation Test, the MMSE based on age and educational norm, the King-Devick Subtest 3 and the Barthel Index during the four-week intervention period.

Participants in Group 2 presented with decreased perceptual processing and cognitive functioning compared to participants from Group 1 after the four-week intervention period. The decreased perceptual processing and cognitive functioning noted in participants in Group 2 were associated with poor oculomotor function, decreased visual efficiency processes, slow saccadic eye movements and a severe dependence in the performance of ADL after the intervention period. The improved perceptual processing and cognitive function noted in participants in Group 1 were associated with a significantly improved oculomotor function, visual efficiency processes, saccadic eye movements and a higher level of functional performance in ADL compared to participants from Group 2 after the four-week intervention period.

The results of this study are supported by findings from previously reviewed literature in Chapter 2 (Table 2.3.) in the sense that; (1) an individual's ability to move effectively and efficiently in their environment is affected by the successful interaction of the individual's cognitive and perceptual systems that precedes the motor response and determines the success or failure of the motor action and task completion within a particular environment. (2) An individual with visual impairment and decreased oculomotor visual performance caused by a stroke may present with cognitive and perceptual deficits affecting their movement and, as such also their functional outcome. (3) The effect of saccadic eye movement training with visual scanning exercises as an intervention has a significant effect on the perceptual processing and cognitive function of participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke. (4) The significant improved perceptual processing and cognitive function post-stroke translate to significantly better visual function and ability to perform visually guided activities of daily living following the stroke. (5) Intensive saccadic eye movement training can re-train and enhance a patient's perceptual processing and cognitive functioning with associated improvements in functional ability.

5.3.4. The effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's anxiety and depression.

Based on literature review it can be concluded that anxiety disorder following stroke (1) significantly interacts with depression to aggravate the severity and course of depression and (2) influences the severity and slowed down the course of recovery from stroke. The presence of depression is significantly associated with the presence of cognitive impairment following stroke (Dam et al, 1989, Egelko et al, 1989; Burvill et al, 1995; Shimoda & Robinson, 1998; Talelli et al, 2004; Kalaria & Ballard, 2001; Jaillard et al, 2010). Murata et al (2000) concluded that major post-stroke depression leads to cognitive impairment, although cognitive impairment does not result in post-stroke depression. The presence of anxiety and depression were assessed weekly by the anxiety and depression subscales of the Hospital Anxiety and Depression Scale (HADS) during the four-week intervention period.

Results from the study demonstrated an improvement in the level of anxiety in participants in Group 1 and Group 2 over the four-week intervention period. However, a difference in level of depression between participants in Group 1 and Group 2 was noted after the four-week intervention period. The level of depression increased in participants from Group 2 compared to participants from Group 1. The level of depression was within normal range in participants in Group 1 compared to Group 2's level of depression that indicated the probable presence of a mood disorder post-intervention.

The effects of the presence of anxiety and depression on cognitive function and functional ability in participants in Group 1 and Group 2 were assessed by the MMSE and the Barthel Index during the four-week intervention period. Based upon the interpretation of the MMSE and depression subscale at baseline, participants in both groups suffered from mild cognitive impairment and presented with a state of depression at the beginning of the intervention period (baseline). The improved level of depression noted in participants in Group 1 is associated with a significantly improved cognitive function and a higher level of functional performance in ADL compared to participants from Group 2 after the four-week intervention period. A greater amount of improvement in level of depression, cognitive function and functional ability was noted over a shorter period of time in participants from Group 1 compared to participants from Group 2. Participants in Group 2 presented with an increased level of depression compared to participants from Group 1 after the four-week intervention period. The increased level of depression noted in participants in Group 2 is associated with decreased cognitive function and a severe dependence in the performance of ADL after the intervention period.

The results of this study are supported by findings of previously reviewed literature in Chapter 2 (paragraph 2.5) in the sense that;

(1) The state of depression noted in participants from Group 1 and Group 2 before rehabilitation commenced may have contributed to the impaired cognitive functioning prior to intervention.

(2) The presence of depression may significantly be associated with the presence of cognitive impairment following stroke (Dam et al, 1989; Egelko et al, 1989; Burvill et al, 1995; Talelli et al, 2004; Kalaria & Ballard, 2001; Jaillard et al, 2010).

(3) The cognitive and physical outcome of stroke is influenced by the presence of depressive disorders in patients who have suffered a stroke. A major depressive disorder is associated with a significantly greater degree of cognitive impairment following the stroke.

(4) Anxiety disorder significantly interacts with depression to influence the severity and course of depression, outcome of ADL and course of recovery in social functioning at long-term follow-up (Astrom, 1996; Shimoda & Robinson, 1998).

(5) Because anxiety disorder does not affect cognitive impairment, it may be concluded that the cognitive impairment observed in the trial was not affected by the presence of anxiety. However, the presence of anxiety interacts with depression and plays an important role in the functional prognosis of patients with post-stroke depression (Astrom, 1996; Shimoda & Robinson, 1998).

5.4. Participation level

The fourth objective related to the second aim of the study was to determine the effect of visual scanning exercises integrated with task-specific activities received by participants from Group 1 versus participants from Group 2 that received task-specific activities alone on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's **quality of life** measured with the **Stroke Impact Scale Version 3.0** and the **Walking ability questionnaire** eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated.

However, during the follow-up following discharge from the TRC after the intervention period of four (4) weeks a large number of participants were lost to follow-up. As a result of the small sample group at week eight (8), week twelve (12), week sixteen (16) and week twenty (20), these results are not discussed in this chapter because no valid conclusions can be drawn from these results. . Results gathered at week eight (8), week twelve (12), week sixteen (16) and week twenty (20) are, however, presented in Addendum 14.

5.5. Discussion on the aims of the study

Based on the results of the oculomotor visual performance and the associated functional ability, perceptual processing and cognitive functioning, as well as the level of anxiety and depression, noted in participants in Group 1 and Group 2 after four (4) weeks of rehabilitation as indicated in the preceding paragraphs, the first aim of the study was only partially reached. The effect of task-specific activities as an intervention approach versus the effect of visual scanning exercises integrated with task-specific activities as an intervention approach on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's (1) oculomotor visual performance; (2) functional ability; and (3) perceptual processing and cognitive functioning was determined on a weekly basis during the intervention period of four (4) weeks.

However, the effect of task-specific activities as an intervention approach versus the effect of visual scanning exercises integrated with task-specific activities as an intervention approach on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's (1) oculomotor visual performance; (2) functional ability; and (3) perceptual processing and cognitive functioning was not determined at eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated. The aim was therefore only partially reached due to a large number of participants that were lost to follow-up following discharge from the TRC after the intervention period of four (4) weeks. As a result of the small sample group at week eight (8), week twelve (12), week sixteen (16) and week twenty (20), these results will not be discussed in this chapter because no valid conclusions can be drawn from these results. Results gathered at week eight (8), week twelve (12), week sixteen (16) and week twenty (20) are, however, presented in Addendum 14.

The second aim of the study was not reached. The effect of task-specific activities as an intervention approach versus the effect of visual scanning exercises integrated with task-specific activities as an intervention approach on participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke's quality of life eight (8), twelve (12), sixteen (16) and twenty (20) weeks after rehabilitation has been terminated was not determined. As a result of the small sample group due to a large number of participants lost to follow-up following discharge from the TRC after the intervention period of four (4) weeks, these results will not be discussed in this chapter because no valid conclusions can be drawn from these results. Results gathered at week eight (8), week twelve (12), week sixteen (16) and week twenty (20) are, however, presented in Addendum 14.

5.6. Limitations of the study

(1) The sample size was limited by the number of participants that could be recruited in a reasonable time. The small size of the sample group limits the generalisability of the findings of the double blind matched clinical trial. Nevertheless, the results of the study corresponded with previous findings in the stroke population. This fact emphasises the importance of saccadic eye movement training with visual scanning

exercises integrated with task-specific activities as an intervention with participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke.

To fit the trial into an acceptable timespan, a double blind randomised matched clinical trial was conducted. Although a randomised controlled trial was not conducted, participants who met the inclusion and exclusion criteria of the study (paragraph 3.7.1. and paragraph 3.7.2.) were screened based on their functional activity level as measured on the Stroke Activity Scale (SAS) by an independent assessor when they were admitted to the TRC. The process was repeated until twelve (12) participants were recruited and allocated to each group. The participants from Group 1 and Group 2 were blinded to the group they were assigned to (Blanton et al, 2006). Following the matching procedure, all participants were adequately matched with regard to their physical condition and randomised based on the outcome. The randomised principle (matched-pair randomised controlled) was applied in combination with the matching of the participants (Chan, Chan & Au, 2006).

Participants were matched, randomly paired and allocated based on their scores on the SAS to ensure that participants in the two groups were comparable with regard to their functional activity level. The two (2) groups were comparable with each other regarding demographic (age, gender, race, affected side post-stroke and dominant side prior to the stroke), home environment, socio-economic status and level of education at the beginning of the study. The demographical data was therefore not expected to have any influence on the outcome of the intervention(s) on the dependent variables.

(2) The drop-out of participants after they were discharged from TRC was a major limitation, although participants received remuneration for travelling costs and were contacted telephonically on a regular basis. The large loss of participants to follow-up prevented the researcher from determining if the long-term effect of the treatment was sustained and whether oculomotor function, perceptual processing, cognitive function, the level of anxiety as well as depression and the associated functional ability spontaneously improved in the control group.

(3) Although two (2) physiotherapists were responsible for the treatment of one (1) group, the principal investigator orientated and trained the two (2) physiotherapists in the task-specific treatment approach to rehabilitation of participants who had sustained a stroke and who suffered from unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke, to ensure that there was no difference in the application of the task specific treatment approach to participants post stroke.

Orientation and in-service training of the two (2) physiotherapists took place prior to the commencement of the trial. The participants in Group 1 and 2 were treated in separate venues to control blinding of the participants throughout the study. The two (2) physiotherapists who treated the participants in Group 1 and Group 2 based their treatment on a client-centered approach to rehabilitation. The client-centered approach to rehabilitation entails the facilitation of active participation and self-responsibility of the participants and their caregivers in the rehabilitation process (Hammell, 2004). The fact that the two physiotherapists may not have complied with the principles of the task-based client-centered approach may be a potential limitation.

(4) The fact that visual-perceptual processing and cognitive function could have been addressed by the occupational therapist and/or the speech-and language therapist is a possibility and is not accounted for in this study.

(5) The researcher did not find any publication with regards to the King-Devick Test's reliability in the stroke population (Lieberman et al, 1983; Oride et al, 1986).

(6) The weekly assessments on the outcome measures may have caused bias because participants probably got to know the outcome measures very well. Using the Mini-Mental State Examination and the SAS regularly could have contributed to a learnt effect and influenced the results.

(7) Emotional liability of participants may have contributed to the level of depression noted in the participants and is not accounted for in this study.

(8) The probable presence of the human immunodeficiency virus (HIV) in the participants, and whether the presence of the HIV may have had an influence on the visual-perceptual processing, cognitive function and associated functional disability and their response and maintenance of their functional gain after the stroke, in the participants were not verified in this study.

5.7. Suggestions for future research

(1) In any follow-up study a larger sample group of participants needs to be recruited. To achieve this, other rehabilitation facilities that are equipped to perform assessments and the intervention need to be incorporated to participate in a multicentre clinical trial.

(2) Inputs from multiple sensory systems including the vestibular system, somatosensory (proprioceptive, cutaneous and joint receptors) and visual system to detect the body's position, motion in space in relation to gravity and the environment are integrated to provide information to establish postural orientation and stability. The vestibular system provides the CNS with information relating to the position and motion of the head with respect to gravity and inertial forces, and as such provide a reference for postural control (Shumway-Cook & Woollacott, 2007). The vestibular system specifically the vestibulo-ocular reflex (VOR) and the optokinetic systems (eye movements) regulate gaze stabilisation. The function of these systems is to maintain a stable retinal image during head motion. Failure to maintain gaze stabilisation may result in the perception that the environment surrounding the individual is blurry or in motion, thereby affecting the individual's ability to stabilise him or herself in relation to the world, which results in impaired postural control and limitation of motor behaviour. Functional impairments as a result of impaired postural control and motor behaviour include difficulty with ambulation and ADL, including driving (Gorman, 2007; Shumway-Cook & Woollacott, 2007).

It is therefore recommended that a continuation of this research should include the assessment of the VOR in a similar trial on patients post-stroke. It is recommended that the follow-up study should determine the effect of an intervention consisting of

VOR-training and saccadic eye movement training integrated with task-specific activities on participants presenting with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders' functional ability and quality of life on patients post-stroke.

(3) Assessment and documentation of participants' functional progress on body impairment, functional activity and participation level as well as their perceived quality of life in response to an intervention consisting of VOR-training and visual scanning techniques through saccadic eye movement training integrated with task-specific activities should include Dynamic Gait Index (DGI). The DGI was developed by Shumway-Cook (1997) to assess a patient's ability to modify gait in response to changing task demands in ambulatory patients with balance impairments. The outcome measure has been used:

a. To measure mobility in older adults with a score below nineteen (>19) as an indicator of increased fall risk (Shumway-Cook & Woollacott, 2007); and

b. To predict fall risk in patients with vestibular dysfunction (Whitney et al, 2000).

5.8. Conclusion

Motor impairment is the most common and widely recognised impairment caused by a stroke. Motor impairment entails the loss or limitation of muscle control, impaired movement and decreased mobility (Langhorne et al, 2009). The combination of motor disability and visual-perceptual defects all contribute to an individual's disability in the home environment, workplace, community participation and decreased quality of life.

Appropriate and effective movement in complex and various environments is guided by the visual system. The importance of the visual system on body impairment-, functional activity-and participation levels has been identified and described in the previous chapters. A lack of evidence on the integration of visual scanning exercises as part of, and integrated with Physiotherapy has been identified in the literature regardless of the important role vision plays in movement and ultimately the functional ability of the patient. The lack of the integration of saccadic eye movement training with visual scanning exercises with task-specific activities described in the literature and regular application thereof in clinical practice urged the researcher to investigate the effect of visual scanning exercises integrated with the task-specific activities as part of physical rehabilitation in participants who have sustained a stroke, and who suffered from unilateral spatial inattention, visual-spatial disorders or visual-constructive disorders as result thereof.

Results of the matched-pair randomised controlled trial indicated that the effect of saccadic eye movement training with visual scanning exercises integrated with task specific activities as an intervention for participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke resulted in significant improvement in impairment level. This improvement is related to improved oculomotor visual performance, visual attention, depression as well as results on functional activity level with regard to the ability to independently complete ADL after four (4) weeks of rehabilitation.

It may therefore be concluded that saccadic eye movement training with visual scanning exercises integrated with task-specific activities as an intervention tend to improve functional ability in participants that presented with unilateral spatial inattention, visual-spatial disorders and visual-constructive disorders post-stroke.