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A Validation Study of Ontario Society of Occupational Therapists Perceptual Evaluation in Stroke Patients

by

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This thesis is dedicated with

deepest love and affection

to my wife, Chiharu Yim

and to my daughter, Hitomi Ngalam Yim

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Abstract

The Ontario Society of Occupational Therapists Perceptual Evaluation (OSOT) has been widely used by occupational therapists in Canada. However, and of concern in this study, the validity and reliability of the OSOT have been only partially established. The purpose of this study, therefore, was to establish further evidence concerning the internal consistency and construct-related evidence of the OSOT. The subjects of this study were 242 stroke patients admitted to the Glenrose Rehabilitation Hospital Stroke Program. Each patient was administered the OSOT, the Functional Independence Measure (FIM), and the Brunnstrom Stages of Motor Recovery (Brunnstrom). Overall, perceptual impairment was found in 61.6% of the subjects.

The internal consistency of OSOT, calculated using Cronbach's alpha, was .89. The OSOT total score correlated .51 with the FIM ADL, .56 with the FIM Cognition, and .23 with the Brunnstrom total scores. The correlations of the OSOT total score with the FIM items scores ranged from .33 to .56.

It was concluded that the OSOT had high internal consistency and the OSOT total score was a good indicator of perceptual impairment in stroke patients.

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Chapter I

The Problem

The Ontario Society of Occupational Therapists - Perceptual Evaluation (OSOT) was developed in 1972 by a group of practising occupational therapists in Toronto, Canada (Boys, Fisher, Holzberg, & Reid, 1991). The original OSOT consisted of 28 test items. The test items were based on known work in the field of perception and neurodevelopmental theories (Boys, Fisher, Holzberg, & Reid, 1988). Performance on each test item is scored using a five point (0, 1, 2, 3, 4) rating scale. For example, on the item which requires the patient to copy four 3-D designs, the patient will get one point for each correct design that he copies. Patients who are unable to respond are awarded a score of zero. The OSOT is supposed to have content-related validity because, with the exception of the tests of Sensory Functions, the test items of OSOT are adopted from "known" perceptual tests. (Appendix A contains the test items included in the original OSOT as well as all the instruments used in this study.)

In a survey of 56 Canadian hospitals with occupational therapy departments, Gane (1976) found that the OSOT was the most frequently used measure for the assessment of perceptual impairment. Further, at this time the OSOT is the only standardized occupational therapy perceptual evaluation tool developed and published in Canada.

Despite its long history and popularity, limited research has been done on the OSOT. A review of literature revealed only one study. Boys, et al. (1988) assessed the interrater reliability and the validity of the OSOT. To establish interrater reliability, the OSOT was administered to a group of 46 patients separately by their case therapists with one of the investigators present. The patient's performance was scored independently by both parties on separate score sheets. The discrepancies/agreements were tallied for each test item. Boys et al. found 93.1% agreement across items for all subjects. They also examined the correlations between each item score and the total score for the functional area to which the item was referenced, the intercorrelations among the six functional areas, and the correlation of each functional area score with the total score. They found that 22 out of 28 item-total functional area correlation coefficients were above .7. The inter-area correlations and the correlation of each area score with the total score ranged from .27 to .85.

To assess the validity of the OSOT, Boys et al. compared the OSOT scores of a group of 80 brain damaged patients (stroke, tumor, normopressure hydrocephalus, or anoxia) and a group of 70 normal subjects in terms of their respective means and standard deviations. The two groups were matched on the variables of age, gender, and level of education. Boys et al. reported that

> one of the most important findings of this study is the instrument's ability to differentiate the impaired patient group from the neurologically normal group on (a) the total score on the battery, (b) all six subtests or functional area scores, and (c) 24 of the 28 test items. (p. 97)

Moreover, using the distribution of raw scores, Boys et al. identified four cut-off scores that could be used to classify perceptual impairment. The cut-off scores and labels used to describe the degree of perceptual impairment were: severe (80 or below), moderate (81-90), mild (91-100), borderline (101-109), and normal (110 or above).

<u>Revised OSOT</u>

The current form of the OSOT is a revised version of the original based on the research findings of Boys et al. (1988). The number of test items was reduced from the original 28 to 18 by eliminating 7 items from the Sensory Function area, 2 items from the Apraxia area, and 1 item from the Body Awareness area (See Appendix A). However, to date, no study has been done to assess the internal consistency and the construct-related validity of the revised OSOT. Clearly, the validity of the inferences drawn from the scores yielded by the shorter revised form of OSOT has not been assessed by Boys et al. (1988).

The revised OSOT is currently being used at the Glenrose Rehabilitation Hospital as a standard test for perceptual impairment of the stroke patients. It is used both to identify patients with perceptual impairment and to indicate the severity of impairment. The classification of degree of perceptual impairment of the revised OSOT (Boys et al., 1991) is as follows: severe (40 or below), moderate (41-50), mild (51-60), borderline (61-69), and normal (70-72) . Further, the severity of perceptual impairment as indicated by this test is purported to have significant impact on the patient's performance in activities of daily living: a higher degree of perceptual impairment is expected to cause greater difficulties in activities of daily living.

Purpose of the Study

As noted above, there have been no studies conducted to assess the performance of the current OSOT in stroke patients. Further, there has been no study which has examined the following two important psychometric properties: (a) the internal consistency of the items in the revised OSOT; and (b) the validity of revised OSOT total score as indicator of perceptual impairment. Therefore the present study was designed to answer the following two questions:

1. What is the internal consistency of the revised OSOT and how does it compare to the original version?
2. Is the revised OSOT total score a valid indicator of perceptual impairment in stroke patients? In other words, is there convergent and discrimination evidence to support the construct-related validity of the OSOT with stroke patients?

Organization of Thesis

This thesis is organised into five chapters. Chapter I contains an introduction to the OSOT and the purpose of the study. Chapter II contains a review of literature relevant to this study. An introduction to the nature of stroke and its impact upon a person is presented at the beginning, followed by a review of the classifications and approaches used in the evaluation of perceptual impairment, and the functional theories of perceptual impairment. The hypotheses for this study are presented at the end of this Chapter. Chapter III contains the method for this study: design of the study, subject population, sampling site, instruments used, and data collection. The data analyses and results of the study are presented in Chapter IV. In Chapter V, a summary of study is presented at the beginning, followed by a summary of findings, limitations of this study, and conclusions. The implications for practice and research are presented at the end of this chapter.

Chapter II

Survey of the Literature

A review of the literature related to the nature of stroke and its impact on a person is presented in this chapter. An introduction to stroke is first presented, followed by a review of the classifications and approaches used in the evaluation of perceptual impairment. This is followed by an overview of the relation between perceptual impairment and side of stroke, location of stroke, language impairment, rehabilitation outcome, activities of daily living and a summary of the above. Lastly, hypotheses generated from these functional theories for construct validation of the OSOT are presented at end of the chapter.

Introduction to Stroke

Stroke, or as it is sometimes called, cerebral vascular accident (CVA), is a collection of signs and symptoms caused by a localized sudden interruption of the blood supply to some part of the brain (Wade, Hewer, Skilbeck, & David, 1985). The World Health Organization defined stroke more precisely as "rapidly developed clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin" (Aho et al., 1980, p. 113). The disturbance of blood supply can be the result of several different pathological processes: thrombosis, embolism, haemorrhage, trauma, neoplasm, and infection involving the brain. In order to cause a stroke, the consequence of these processes has to be either occlusion or rupture of cerebral blood vessel(s) (Wade et al., 1985). For the purpose of this study, the World Health Organization's definition is adopted.

A stroke can affect a person in many ways. Since the brain is the controlling centre for many body functions, damage to different areas will cause various functional deficits. The stroke survivors may suffer from paralysis of half of the body, loss of balance, or lack of awareness of sensory stimuli. These impairments of body functions may lead to dependence in personal care activities, loss of job, or inability to pursue leisure activities. The World Health Organization's disablement model is a useful model for organizing the effects of stroke (World Health Organization, 1980). According to this model, a pathological process such as stroke which causes damage at the biological level may result in various forms of impairment, which may lead to different degrees of disability, which in turn may lead to handicap. For example, motor impairment in one leg may lead to disability in walking which in turn may lead to the handicap of not being able to go to meet friends.

The severity of stroke can also be assessed at different levels. At the biological level, it may be assessed in terms of the location and amount of brain damage; i.e., the location and size of the lesion(s) demonstrated on Computerized Tomography scanning. At the impairment level, the severity of stroke may be assessed by the type and severity of the neurological impairment. Although there are no definite ways to classify the types of impairment caused by stroke, from a clinical perspective the most common types of impairment include physical, perceptual, cognitive, communication, and emotional (Thompson & Morgan, 1990; Gresham & Granger, 1987; Wade et al., 1985). At the level of disability, the severity of stroke may be measured by the degree of independence in daily activities. At the level of handicap, severity may be measured by impact on work, return to home, or social engagement (Ebrahim, 1990; Wade et al., 1985).

Rehabilitation of stroke is most effective when carried out by a well-functioning interdisciplinary team (Stonningston & Browne, 1987; Wade, et al., 1985). Generally, the members of the rehabilitation team include physicians, nurses, occupational therapists, physical therapists, psychologists, recreational therapists, social workers, speech-language pathologists, and the patient. This core team may be expanded if necessary to meet the needs of an individual patient. All members of the team should have rapport with the patient and provide psychosocial support. Each member also has his/her own specific role to play on the team. For example, Trombly (1989) suggested occupational therapists should assess level of independent functioning, sensory deficits, perceptual and cognitive deficits, motor deficits, visual deficits, and emotional adjustment. Although other team members share responsibility in assessing some of these functions, the occupational therapist usually holds responsibility for the evaluation of perceptual function in many rehabilitation hospitals (Stonningston & Browne, 1987, Wade, et al., 1985).

Perceptual Impairment

Zoltan, Siev, and Freishtat (1986) defined perception as "the ability to interpret sensory messages from the internal and external environment such that the sensation has meaning" (p. 180). Bouska, Kauffman, and Marcus (1990) defined perception as "the dynamic process of receiving (perceiving) the environment through sensory impulses and translating those impulses into meaning based on a previously developed understanding of that environment" (p. 706). Clearly, there are two features that characterize perception. First, perception is a multisensory phenomenon; it involves simultaneous and integrated use of all sensory systems: visual, tactile, auditory, kinaesthetic, vestibular, and olfactory (Bouska et al., 1990). Second, perception involves interpreting the sensory stimuli.

In evaluating the perceptual function of stroke patients, occupational therapists are working with the pathological aspect of perception, that is, perceptual impairment. In the literature, several terms have been used as synonyms for perceptual impairment: perceptual deficit, perceptual disorder, perceptual dysfunction, and perceptual problem. Within the context of this paper, perceptual impairment is used as a global construct to describe a wide variety of deficits. The term perceptual deficit is used to refer to each of the specific deficits. A stroke patient can acquire one or more perceptual deficits. Individually many of these deficits are quite rare, but as a group together they are quite common (Wade, et al., 1985).

There is no universal agreement on the best classification system for perceptual impairment (Wade, et al., 1985). Zoltan et al. (1986) used five functional categories to group perceptual deficits together. The five functional categories are gross visual skills deficits, apraxia, body image/body scheme disorders, spatial relations syndrome, and agnosia. They are supposed to be subconstructs subordinate to perceptual impairment. Thompson and Morgan (1990) did not include gross visual skill deficits as a category. Okkema (1993) used only three functional categories to group perceptual deficits: visual perception, body awareness, and motor planning. Although the terminology varies from one author to another, the perceptual deficits being described are very similar. The comparison of the classification systems of perceptual impairment is shown in Table 1.

Evaluation of Perceptual Impairment

The best way to assess perceptual impairment is open to debate (Okkema, 1993). One approach is to observe a patient while he/she is doing a functional activity like dressing. Arnadottir (1990) is one of the believers in this approach. She suggested that observations of activities of daily living can be used to assess neurobehavioral dysfunction as well. However, the problem with this observational approach is that it is sometimes hard to determine whether the difficulty observed in performing a self-care activity is the manifestation of perceptual impairment or some other impairment such as inattention.

A second more standardized approach to the assessment of perceptual impairment involves evaluation of the patient in a test situation. The main advantage of this approach is that deficits are defined more clearly (Bouska, et al., 1990). The OSOT is an example of this approach.

Table 1

Comparison of Classifications of Perceptual Impairment by Sub-constructs

Zoltan et al. (1986)	Thompson & Morgan (1990)	Okkema (1993)
Gross visual perception		Visual skill deficits
Apraxia	Apraxia	Motor planning
Body image/body awareness	Body image/body scheme	Body awareness scheme disorder
Spatial relation syndrome	Spatial relationship	
Agnosia	Agnosia	

Relation between Hemisphere of Stroke and Perceptual Impairment

In clinical practice it is generally believed that perceptual impairment occurs more commonly in non-dominant hemisphere damage than dominant hemisphere damage. However, studies have shown inconsistent results. Wade et al. (1985) illustrated that the incidence of different types of perceptual deficit are consistently higher in right hemisphere damage (RHD) than left hemisphere damage (LHD) for the right-handed. Some of the studies that are quoted by Wade et al. are as follows:

> Hecaen (1962) studied over 400 patients with various types of cerebral damage, and noted that visual neglect occurred ten times more often in patients with RHD than in those with LHD. Dressing apraxia occurred in 21 % of patients with RHD, whereas the corresponding figure for those with LHD was 4%. Diller and Weinberg (1977) also found that unilateral neglect was more frequently found in RHD, which is 40 %, but only rarely in LHD. Denes et al. (1982) noted that 33% of RHD versus 21% of LHD stroke patients showed unilateral neglect on admission to hospital. (p. 104)

In the original validation study of the Rivermead Perceptual Evaluation Battery (RPAB), Whiting, Lincoln, Bhavnani, and Cockburn (1985) found that stroke patients with RHD (n =20) scored significantly lower than patients with LHD (n = 18) on five out of the 16 subtests ($p < .05$). In a more recent study of frequency of perceptual impairment in stroke patients, Edmans and Lincoln (1989) administered the RPAB to 150 stroke patients, half of whom were RHD and half of whom were LHD. Based on the total score, they found that perceptual problems were identified in 81% of RHD patients and 71% LHD patients. However, the difference between the two frequencies was not statistically significant. Edmans and Lincoln concluded that "perceptual problems are common following stroke in both right and left hemiplegic patients admitted to hospital" (p.269). Clearly, the findings of these studies are inconsistent regarding the differences in the incidence of perceptual impairment between RHD and LHD patients. Part of the reason may be attributed to the fact that perceptual impairment in each of the studies was measured with different instruments. An additional reason for the inconsistent findings may be due to the use of different perceptual deficits as an indication of perceptual impairment. This makes it difficult to compare findings of different studies.

Relation between Location of Stroke and Perceptual Impairment

Stroke can affect different locations of the brain which are responsible for different body functions. The types of impairment of stroke affecting the cerebral cortex (where the parietal lobe is located) are quite different from the types of impairment of stroke affecting the brainstem. Arnadottir (1990) described the parietal lobe as having three functional areas: primary, secondary, and tertiary zones. These areas are defined on the basis of functional complexity. The detection of fine touch, proprioception, and kinaesthesia takes place in the primary zone . The secondary zone is responsible for integrating sensory information from multiple sensory sources. It deals with tactile discrimination and localization, and stereognosis. The tertiary sensory zone is responsible for the integration of the functions of different cortical areas. These include gnosis, praxis, and body image. In addition to these functions, a part of Wernicke's speech area, which is situated within the left parietal lobe, has a role in comprehension of words. The right parietal cortical area, parallel to Wernicke's area on the left side, plays a role in interpretation of tones and loudness and timing of words as well as modulating sound and verbal output. Obviously, patients who suffer parietal lobe damage caused by stroke or other pathological processes are likely to have perceptual impairment, which may be complicated by language impairment.

In contrast to cortical strokes, a stroke localized in brainstem (The term "brainstem" used in this article includes the following structures: midbrain, medulla oblongata, and cerrbellar.) should not cause perceptual and language impairments. The effect of stroke in brainstem is likely to be localized in the brainstem if the stroke is caused by rupture of an artery supplying the brainstem. However, if a brainstem stroke is caused by occlusion, the effect of stroke may move beyond the brainstem to the cortical area. As a result, perceptual impairment may also occur in brainstem strokes. Specific impairments resulting from localized brainstem strokes include ipsilateral cranial nerve involvement, resulting in hemisensory deficits and hemiplegia. With involvement of the cerebellar tracts, significant ipsilateral ataxia and incoordination result. Dysarthria and dysphagia are also common problems resulting from brainstem strokes (Delaney and Potter, 1993). Although brainstem strokes may cause hemisensory deficit, patients who suffer from this problem are usually aware of it and therefore are able to compensate for the loss of sensation in performing daily activities. Consequently, hemisensory deficit caused by brainstem stroke is essentially not perceptual impairment.

Relation between Language Impairment and Perceptual Impairment

Clinically, language and perceptual impairment are two distinct problems. However, there are empirical and theoretical rationales supporting the notion that language and perception should be related. Learning theorists such as Bandura (1986) and Skinner (1957) agree that a great deal of human thought is linguistically based. Piaget (1926) believed that language is a verbal reflection of the individual's nonlinguistic thought. In other words, language determines cognition. The most prominent theory of language and thought was developed by the Soviet psychologist Lev Vygotsky (1986). In Vygotsky' theory, language is the medium for all higher cognitive processes such speaking, perceiving, and thinking. In other words, we speak, think, and perceive in language.

Taylor (1972) described a two-stage or dual-process theory about perception. According to this theory, perception consists of two stages, an apperceptive stage and an associative stage. During the apperceptive stage, the process of responding to basic stimuli, distinguishing outline, shape, and shade, and perceiving stimuli as a whole takes place. The associative stage involves the process of giving the whole stimulus a meaning, such as a name, an identity, and recognizing it as an object with a particular function. In order to give a meaning to the stimuli, language is the means for this process.

There is also empirical evidence to demonstrate the relationship between perception and language impairment. Wade et al. (1985) have suggested that as many as 40% of aphasic patients suffer from ideomotor apraxia. In Edmans and Lincoln (1989) study, 97% of the dysphasic LHD patients were identified by the RPAB to have perceptual problems, whereas there were only 47% of non-dysphasic LHD patients having perceptual problems.

However, Smith and Lincoln (1989) found contrary findings. The purpose of their study was to examine the relationship between linguistic deficit and perceptual deficit. Thirty stroke patients were selected for this study: 10 RHD non-dysphasic patients, 10 LHD non-dysphasic patients, and 10 LHD dysphasic patients. The subjects were assessed on The National Adult Reading Test, RPAB, The Object Naming Test, and The Token Test. Results showed that there were no differences in the proportion of patients with perceptual deficits among the three groups of patients. Smith and Lincoln concluded that "perceptual problems and language problems are largely independent" (p.10). However, the main threat to the internal validity of this study is the small sample size. This can easily lead to type II error because of limited power. In contrast, in Edman and Lincoln's study there were 35 and 40 patients in each of the dysphasic and non-dysphasic groups respectively. Therefore it could be argued that language problems and perceptual problems in stroke are related on both conceptual and empirical grounds. After all, from a medical perspective, perceptual and language problems in stroke are related because both are caused by stroke.

Relation between Rehabilitation Outcome and Perceptual Impairment

Research studies have repeatedly shown that perceptual impairment is an important factor in determining outcome following stroke. In a retrospective study of 271 patients, Anderson (1971) found that severe weakness of the hemiplegic side of the body on admission or severe perceptual or cognitive impairment either alone or in combination with any other deficit(s) are poor prognostic indicators. The findings also showed that the presence of dysphasia or a hemisensory deficit and age are unrelated to outcome. In this study, outcome was defined as length of hospitalization and level of independence in self care and ambulation.

Feigenson, McDowell, Meese, McCarthy, and Greenberg (1977a) found almost identical results in another retrospective study of 248 stroke patients admitted to a stroke rehabilitation unit over a sixteen month period. In this study, "outcome was defined in terms of discharge destination (home or elsewhere), and functional status on discharge was measured by ability to perform activities of daily living, ability to walk, and length of stay" (p.652). Results of this study showed that severity of weakness of the hemiplegic side of the body on admission, long onset to admission intervals, and the presence of severe perceptual or cognitive impairment or homonymous hemianopsia were related to unfavourable outcome and increased length of stay. The age of the patient, dysphasia, hemisensory deficit, diabetes, or hypertension were unrelated to the patient's functional status on discharge, discharge destination, or length of stay. Feigenson, McDowell, Meese, McCarthy, and Greenberg, (1977b) repeated the study on the another group of 318 patients. The results of the second study were essentially the same as the first one.

The results of a study recently completed in Canada by Mayo, Korner-Bistensky, and Becker (1991) also suggest that perceptual impairment is strongly correlated with recovery time after stroke. In this study 93 stroke patients admitted to a rehabilitation hospital were monitored daily to determine the length of time needed to become independent in sitting, walking, and stair climbing. The recovery time needed to achieve independence in each of these activities was statistically modelled in relation to a set of variables: age, gender, side of stroke, comorbidity, the presence of depression and the extent of impairment in perception, cognition, auditory comprehension, and verbal expression. Results showed that perceptual impairment was found to be one of the four variables influencing recovery time of the mobility functions.

Relation between Activities of Daily Living and Perceptual Impairment

Bernspang, Asplund, Eriksson, and Fugl-Meyer (1987) investigated the relative importance of motor, visual perceptual, and orientation functions for self care ability in a group of 109 stroke patients. Measures of self care ability, motor function, visual perception, and orientation to time and space were administered to the subjects within two weeks of a stroke. Based on a factor analysis, Bernspang et al. suggested that visual perception could be assigned to one of two factors. One factor characterized low-order perception, while the other factor characterized high-order, meaningful perceptual functions. Discriminant analyses showed that the actual level of self care proficiency could be predicted in 70% of the cases by four variables: motor function, low-order perception, high-order perception, and orientation. The dominating predictor was motor function, and the next highest was high-order perception. It should be noted that in this study patients who could not follow instructions for reasons such as confusion and patients with global aphasia were excluded. As a result, aphasic patients who frequently suffer from apraxia may have been excluded from the study. Consequently, the frequency of perceptual cognitive impairment in this group of subjects might have been underestimated. Despite this, perceptual impairment still remained the second strongest predictor for self care independence.

Edmans and Lincoln (1990) studied the relation between visual perceptual impairment and independence in activities of daily living in 150 stroke patients (75 left hemiplegia and 75 right hemiplegia) who were admitted consecutively to a hospital. The RPAB was used to measure visual perceptual impairment and the Rivermead ADL scale was used to measure self care and household activities. The correlations between the RPAB total score and the three scales of the ADL assessment were found to be significant (self-care _r_ = .65, p<.001; household 1 _r_ = .69, p<.001; household 2 _r_ = .49, p<.001). Although the ADL scale is not commonly used in North America, it has been reported as a reliable and valid measure of ADL (Whiting and Lincoln, 1980).

Titus, Gall, Yerxa, Roberson, and Mack (1991) administered a battery of perceptual tests, designed to assess seven categories of perceptual impairment (gross visual skills, visual-perceptual skills, body scheme, visualspatial skills, visuomotor skills, agnosia, and apraxia), to 25 male stroke patients. The scores on these perceptual tests were correlated with the Klein-Bell ADL scores. The Shape subtest of the Haptic Visual Discriminant Test with the left hand had the strongest relation with the Klein-Bell ADL score (_r_ = .51, p=.01), followed by the Texture subtest of the Haptic Visual Discrimination Test with the left hand (_r_ = .45, p=.02), and the Block Design subtest of the Wechsler Adult Intelligence Scale-Revised (_r_ = .41, p=.04).

There are several limitations that should be considered when interpreting these results. First, the sample size of 25 subjects is small. Second, the subjects were uniformly male. Third, the mean age of subjects (59.2 year old) was younger than the typical stroke population which is usually between sixty and seventy years of age. However, the similarity between the correlations found in this study and in Edman and Lincoln's study can serve to increase confidence in the soundness of the findings.

Summary of Functional Theories about Perceptual Impairment

It is not clear whether perceptual impairment is more prevalent in right hemisphere stroke or left hemisphere stroke. While some researchers reported that perceptual impairment was more prevalent in right hemisphere stroke, others reported that the difference was not significant. No researcher reported that the prevalence of perceptual impairment was significantly lower in left hemisphere stroke than in right hemisphere stroke. On the other hand there is no doubt that perceptual impairment should not occur in localized brainstem strokes. The argument that perceptual impairment is related to language impairment is supported on both theoretical and empirical grounds. A number of researchers have shown that perceptual impairment is related to activities of daily living (some studies used the term self care) such as dressing and mobility. The correlations ranged from .4 to .6. Studies have also shown that patients who suffer perceptual impairment are less likely to return home than those without.

Hypotheses

As described earlier, the purpose of the present study was to examine the internal consistency and construct-related evidence of the revised OSOT. The hypotheses formulated on the basis of the literature reviewed and related to the purpose of this study were:

H1: The internal consistency of the OSOT exceeds .8, therefore justifying the use of a single total score.

H2: a) The OSOT total correlates with measures of activities of daily living (ADL), CVA location, level of help for medication, and discharge location.

b) The OSOT total does NOT correlate with the measures of motor recovery, or the following theoretically unrelated variables: age, gender, and CVA type.

Chapter III

Method

As noted in the previous two chapter, there has not been a study on the reliability and validity of the revised OSOT. The purpose of this study is to address this problem by examining the internal consistency and the construct validity of the revised OSOT, i.e., the validity of the OSOT total score as an indicator of perceptual impairment and the accuracy of classifications of degree of perceptual impairment. This study was a correlational study, which according to Cronbach (1971), is one of the three categories of procedures used to examine construct validity. In this chapter, a description of the population and the sampling site of the subjects is first provided. This description is followed in turn with a description of the measuring instruments used and the data collection process followed. Lastly, methods of data analysis used to test the hypotheses presented at the end of Chapter II are briefly introduced. As the analyses were conducted in stages, with later stages dependent upon the results of a previous stage, a more detailed description of the data analyses performed together with the results are provided in the next chapter.

Subject Population

The incidence rate of stroke in Western countries is about 150-250 per 100,000 people per year (Wade et al., 1985). Based on this figure, there should be approximately 1,000 strokes in Alberta per year. In terms of severity of impairment, strokes cover a wide spectrum. Those patients who are rehabilitated in facilities such as the Glenrose Rehabilitation Hospital are considered to be the 'middle band' of the spectrum. Very severe stroke patients, for example, those who are still in coma, are not suitable candidates for rehabilitation. Very mild stroke patients who completely recover within a short period of time, do not need rehabilitation and consequently, are not treated in rehabilitation hospitals.

The subjects of this study were drawn from the population which constitutes the 'middle band' of the entire stroke population or, in other words, stroke patients who need rehabilitation. Unfortunately, the percentage of stroke patients who require rehabilitation is not available.

Sampling site. The sampling site was the Glenrose Rehabilitation Hospital, Edmonton. This hospital is the single largest rehabilitation facility in Alberta; it provides rehabilitation programs for the majority of stroke patients who live in the northern part of Alberta. During 1992, approximately 200 stroke patients were admitted to the Glenrose for rehabilitation.

Instruments

Functional Independence Measure (FIM). The FIM (Linacre, Heinemann, Wright, Granger, & Hamilton, 1991) is a well known measure for determining the degree of disability that patients experience and the progress that they make through programs of rehabilitation. It consists of 18 items corresponding to different behaviours which contribute to the measure of disability. Each behaviour is assessed using a seven point rating scale (see Appendix A). As well as yielding individual item scores and total score, the items can be combined to yield two subscale scores: one for ADL domain and the second for Cognition domain. The inter-rater reliability, internal consistency, responsiveness over time, and construct validity of the FIM have been established. Hamilton, Laughlin, Fiedler, and Granger (1994) studied the interrater reliability of the FIM in 89 facilities involving data of 1018 patients. The FIM total, domain, and subscale intraclass correlation coefficients (ICC) were calculated by using ANOVA; the item score agreement was calculated using the Kappa coefficient. Hamilton et al. found that the ICCs ranged from .89 to .96; item Kappa coefficients ranged from .53 to .66. They concluded that the FIM is reliable when used by trained/tested inpatient medical rehabilitation clinicians.

Using data on 11,102 general rehabilitation patients, Dodds, Martin, Stolov, and Deyo (1993) found that Cronbach's alpha of the FIM on admission was .93. They also found support for the construct validity of the FIM by its ability to discriminate patients on the basis of age, comorbidity, and discharge destination. The FIM was also shown to be able to reflect significant functional gains during rehabilitation.

Granger, Hamilton, Linacre, Heinemann, and Wright (1993) conducted a study to scale the FIM with Rasch Analysis and to determine the similarity of scale measures across impairment groups. The results of the Rasch Analysis yielded two interval measures: the first one, consisting of the first 13 items reflects disability in ADL; and the second, consisting of the last five items, reflects disability in cognition. The construct validity of the FIM was further supported by the patterns of items difficulties across impairment groups.

Brunnstrom Stages of Motor Recovery (Brunnstrom Stages). The Brunnstrom stages (Twitchell, 1951) have been used for many years in rehabilitation settings to describe a stroke patient's motor impairment. Hand, arm, leg, and foot motor impairments are independently measured using separate 7-point Guttman scales. The forms for recording the stage of recovery of hand, arm, leg, and foot are provided in Appendix A for reference. A score of overall motor impairment can be obtained by combining the scores of the four scales. Total scores range from 4 to 28.

The original Brunnstrom stages were first described by Twitchell (1951). He noted that the motor recovery following stroke followed a predictable, stepwise course, and that although the patient may reach a plateau at any stage along the recovery sequence, no stages are skipped nor is the order of the stages ever altered. Based on Twitchell's work, Brunnstrom (1970) identified and defined six recovery stages which were measured using a six-point scale (1,2,3,4,5,6) and which described how the hemiplegic arm and leg progressed through these stages. To answer the question of whether the six stages of recovery actually represented sequential recovery stages, Brunnstrom compiled the data of 118 stroke patients and found that "no patients skipped any of the stages" (p.37). The Brunnstrom stages were subsequently revised from a 6-point to a 7-point scale by Gowland et al. (1993) when it was used as part of the Chedoke - McMaster Stroke Assessment. Moreover, Gowland et al. assessed the psychometric properties of the Chedoke - McMaster Stroke Assessment. They assessed the intrarrater, interrater, and test-retest reliabilities by using the intraclass correlation coefficient (ICC). They found that the ICCs for the Brunnstrom stage scores ranged from .93 to .98. Construct validity of the Brunnstrom stage was studied by examining the correlations between this measure and the

Fugl-Meyer Test (Fugl-Meyer, Jaasko, Leyman, Olsson, & Steglind, 1975), which measures similar attributes. Gowland et al. found correlations that ranged from .93 to .95 ($p<.001$).

Data Collection

The OSOT, the FIM, and the Brunnstrom are routinely administered to all stroke patients admitted to the Glenrose Rehabilitation Hospital. The scores of these instruments are noted at the intake conference, which is usually between the first and second week after admission. These scores together with all other demographic variables, are available in clinical records. Data collection was therefore unobtrusive.

The OSOT was administered by occupational therapists. The experience of the therapists administered the OSOT during the data collection period varied due to staff changes. It ranged from newly hired graduates to senior therapists. There were also a few occupational therapy students administering the OSOT under the supervision of a therapist.

The FIM was primarily scored by nurses. The arm and leg scales of the Brunnstrom were primarily scored by the occupational therapists; the leg and foot scales were scored by physiotherapists.

Items scores of the OSOT were not recorded as part of patients' records. They can only be retrieved from the OSOT forms which were usually destroyed after the patients were discharged from the hospital. In order to collect OSOT forms with item scores, the occupational therapists on Stroke Program were requested to keep the forms until one hundred forms with item level information were collected for this study.

The demographic variables considered in this study included age, gender, CVA side, CVA location, CVA type, level of help for medication, and discharge location. Data entry was completed by the Stroke Program secretary.

Analysis of Data

All data analyses were conducted with the Statistical Program for the Social Sciences (SPSS) "Windows version". Given the sequential nature of the analyses completed, with one stage dependent upon the results of a previous stage, the statistical tests used are described in the next chapter together with the results they yielded.

Chapter IV

Data Analyses and Results

The results of the statistical analysis completed to test each hypotheses are described in this chapter together with the results yielded by each testing procedure. The presentation begins first with a description of the sample of subjects, followed by a description of the comparability of the subjects with the OSOT item scores and those without item scores. This description is then followed in turn by a discussion of the internal consistency of the OSOT and the correlations of the OSOT with the variables described in Hypothesis 2.

Sample of Subjects

The clinical records of all stroke patients admitted to the Glenrose Rehabilitation Hospital from May of 1993 through October of 1994 were initially analyzed; 326 patient records were found. Of this number, there were 46 records with missing FIM scores and/or Brunnstrom scores, reducing the total number of subjects to 280. Of the 280, 38 subjects scored zero in OSOT. An OSOT total score of zero on the clinical records of this hospital may indicate either the patient truly scored zero on the OSOT or the OSOT total score was not available at the intake conference. There are basically two reasons for not having the OSOT completed at the intake conference. First, there may be inadequate time to complete an administration before intake conference. Second, the therapist may be convinced by clinical observation that testing with the OSOT is not necessary because the patient does not have a perceptual impairment. Since a zero score has ambiguous meaning, the subjects with zero OSOT scores were also excluded from further data analysis. Consequently, there were 242 subjects for this study.

The subjects excluded from the study were compared with those included on demographic variables to determine if there are any significant differences between these two groups. The Mann-Whitney U Rank Sum Test (Gravetter and Wallnau, 1988) was used to determine if there was significant age difference between the two groups. Chi-square tests (Gravetter and Wallnau, 1988) were conducted for other demographic variables: gender, CVA location, CVA type, and CVA side. As shown in Table 2, no significant differences were found between the included and excluded groups in terms of these demographic variables.

The following demographic description, therefore, is restricted the final sample:

Age. The ages of the subjects ranged from 22 to 92. The mean was 69.17, and standard deviation was 12.62.

Table 2

Demographic Characteristics of Subjects

	Subject			
Characteristic	Included (n=242)	Excluded (n=84)	Value of Statistic	p-value
			z value	
Age			-1.55	.1222
Mean age =	69.17	66.83		
SD =	12.62	12.05		
			Chi-square	
Sex			1.70	.1921
Male =	133 (55.0%)	53 (63.1%)		
Female =	109 (45.0%)	31 (37.9%)		

...cont'd

Cont'd Table 2

Characteristic	Subject: Included (n=242)	Subject: Excluded (n=84)	Value of Statistic	p-value
			Chi-square	
CVA Side			.82	.3653
L =	127	40		
	(53.3%)	(47.6%)		
R =	111	44		
	(47.7%)	(52.4%)		
* 146 scored 60 or below (L:83, R:63)			z=.8355	>.05
			Chi-square	
CVA Type			.42	.5177
Haemorrhage =	44	18		
	(18.2%)	(21.4%)		
Non-haemorrhage =	198	66		
	(81.8%)	(78.6%)		
* 149 scored 60 or below (haemorrhage:32, non-haemorrhage:117)			z=1.04	>.05

...cont'd

Cont'd Table 2

Characteristic	Subject: Included (n=242)	Subject: Excluded (n=84)	Value of Statistic	p-value
CVA Location			Chi-square .28	.5965
Cerebrum =	215 (89.6%)	76 (91.5%)		
Brainstem =	25 (10.4%)	7 (8.5%)		
* 148 scored 60 or below (cerebral: 132, brainstem: 16)			$z=.1637$	$>.05$

Gender. Of the 242 subjects, 55.0 % were male, and 45.0 % were female. Results of binomial test (Gravetter and Wallnau, 1988) showed that the difference between the proportion of males and the proportion of females was not significant at .05 level.

CVA side. Regarding CVA side, 52.5 % of the stroke involved the left side of the brain and 45.9 % involved the right side. Only four subjects (1.7 %) had a stroke involving both sides of the brain. Of the 127 subjects who had a left CVA, 83 (65.4%) were classified by the OSOT total score as perceptually impaired (60 or below). Whereas, of the 111 subjects who had a right CVA, 63 (56.8%) were perceptually impaired. Results of binomial test showed that for the subjects who were identified as perceptually impaired, the difference between the proportion of left (56.8%) and the proportion of right (43.2%) was not significant at .05 level.

CVA type. Regarding CVA types, 18.2 % of the strokes were haemorrhagic and 81.8 % were non-haemorrhagic strokes which included mostly embolic and thrombotic strokes, a few lacunar strokes, and several cases of trauma or tumor. Of the 198 subjects who had a non-haemorrhagic stroke, 117 (59.1%) were classified as perceptually impaired, while, of the 44 subjects who had a haemorrhagic stroke, 32 (72.7%)

were perceptually impaired. Although there was a higher percent of haemorrhagic stroke patients having perceptual impairment than non-haemorrhagic stroke patients, the difference is not significant at .05 level.

<u>CVA location</u>. Lastly, regarding CVA location, 89.6% of the strokes involved the cerebral hemisphere and 10.4 % involved the brainstem. Of the 215 subjects who had a cerebral stroke, 132 (61.4%) were classified as perceptually impaired. While, of the 25 subjects who had a brainstem stroke 16 (64%) were perceptually impaired. For these subjects, the difference between the proportion of cerebral stroke and that of brainstem stroke was not significant at .05 level.

The finding that 64% of the brainstem stroke patients were perceptually impaired is unusual because brainstem stroke is not supposed to cause perceptual impairment. However, as mentioned in Chapter II, if a brainstem stroke is occlusive in nature, there may be diffused effect to the other parts of the brain and consequently may cause perceptual impairment. The data of the 16 brainstem stroke patients who were identified as perceptually impaired were further examined to ascertain the type of stroke. It was found that 12 had a non-haemorrhagic stroke and four had a haemorrhagic stroke. This would imply that 16% (4 out of 25) of brainstem stroke, which according to previous findings should have been localized strokes, may have been incorrectly classified as perceptually impaired. It is speculated that this finding may be due to errors in scoring.

Overall, perceptual impairment was found in 61.6% of the subjects (see Figure 1 for the distribution of degree of perceptual impairment of all subjects).

<u>Comparability of subjects with and without OSOT item scores</u>. Altogether, 102 completed OSOT forms were collected, 11 of which were not used because the subjects were excluded from the study for the reason identified in the previous section. As shown in Figure 2, the distribution of OSOT total score of the 91 subjects for whom OSOT items scores were available is similar to that of the 151 subjects for whom OSOT item scores were not available. To determine whether the group of subjects with item scores was different from those without, t-tests (Glass and Hopkins, 1984) were conducted to compare these two groups of subjects on the following variables: age, OSOT total score, Brunnstrom totalscores, FIM ADL scores, and FIM cognition scores. Levene's test (Norusis, 1993) was used to inspect equality of variance. As shown in Table 3, the results reveal that even though the two groups were not equal number, the

Figure 1. Distribution of Degree of Perceptual Impairment of All Subjects

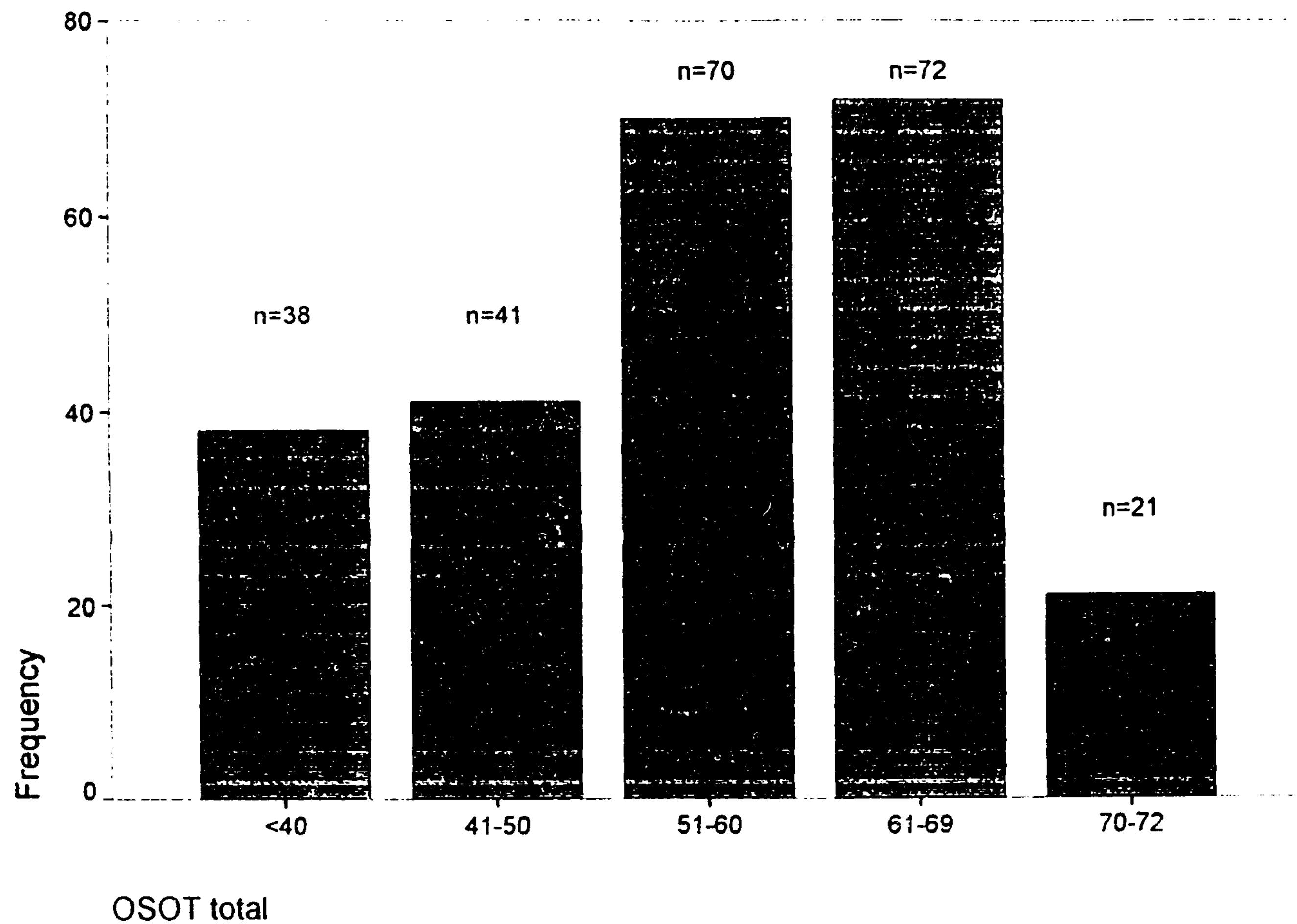
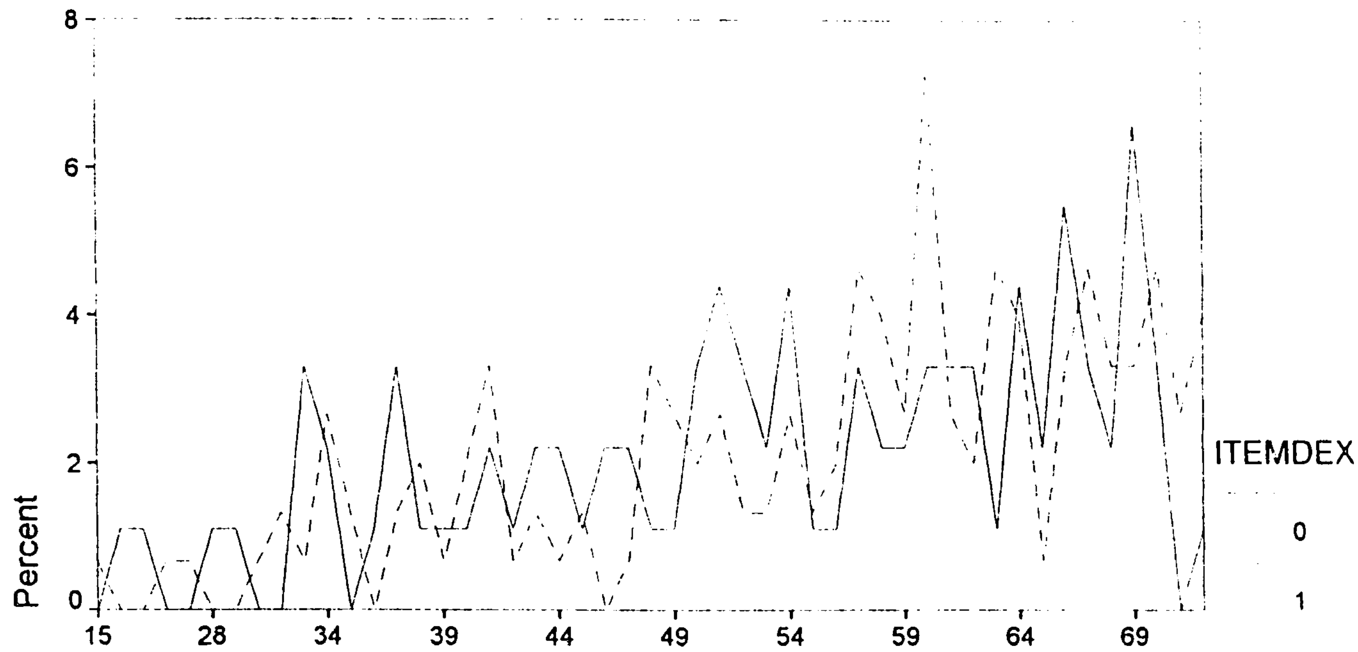


Figure 2. Distribution of OSOT total score of subjects with and without item score



OSOT

Itemdex = 0 : without item score

Itemdex = 1 : with item score

Table 3

Comparisons of Groups of Subjects with and without OSOT Item Scores

Variables		With Forms (n=91)	Without Forms (n=151)	Levene's Test	t-test
Age	mean	71.0	68.1	F=1.619	t=-1.80
	SD	11.87	12.97	(p=.204)	(p=.073)
OSOT	mean	53.4	55.7	F=.275	t=1.37
	SD	12.87	12.19	(p=.601)	(p=1.71)
Brunnstrom Total	mean	15.3	15.5	F=2.351	t=.19
	SD	6.58	7.09	(p=.126)	(p=.847)
FIM ADL	mean	53.3	61.5	F=.235	t=3.02
	SD	20.73	19.84	(p=.628)	(p=.003)
FIM Cog.	mean	20.7	24.0	F=.173	t=3.09
	SD	8.26	8.07	(p=.678)	(p=.002)

inequality of variance was not significant. Further, the group mean of subjects with item scores is not significantly different from the group of subjects without item scores for each of the following variables: age, OSOT total, and Brunnstrom total (See Table 3). However, the two groups differed in both FIM ADL and FIM Cognition. The mean FIM ADL and the mean FIM Cognition for the group of subjects with OSOT item scores are each significantly lower than the corresponding means for the group without item scores (Table 3). Further examination of the data revealed that for those who scored between 70 to 72 on the OSOT (normal range), there were relatively fewer subjects in the group with the OSOT item scores (4.4%) than in the group without the item scores (11.3%). Consequently, the mean FIM ADL and the mean FIM Cognition could have skewed by having fewer perceptually normal and less disabled subjects in the group with item scores.

Internal Consistency

As mentioned earlier, only 91 out of 242 subjects, for whom OSOT item scores were available, were included for this part of data analysis. The internal consistency of the revised OSOT was computed using Cronbach's alpha (Cronbach, 1951). As summarized in Table 4, the value for the full form was .89. Table 4 also shows the valve for alpha when each item is deleted. There was no major change in alpha value

Table 4

Reliability Analysis (Cronbach's alpha)

Item Deleted	Mean	SD	Alpha
Scanning	2.53	1.50	.88
Neglect	2.96	1.41	.88
Motor plan	3.44	0.82	.89
Copy 2D design	2.47	1.24	.88
Copy 3D design	2.64	1.24	.88
Body puzzle	3.27	0.97	.89
Draw a person	2.66	1.34	.88
R-L discrimin.	3.21	0.99	.89
Clock	3.05	1.13	.88
Peg board	2.59	1.45	.88
Draw a house	3.09	1.25	.88
Shape	3.62	0.63	.89
Color	3.59	0.76	.89
Size	3.79	0.62	.89
F/G discrimin.	2.86	0.93	.89
Proprioception	2.44	1.62	.89
R stereognosis	2.54	1.57	.90
L stereognosis	2.72	1.48	.89
No items deleted	2.97	1.21	.89

for any one of the item. These findings support Hypothesis 1. Consequently, it would justify the use of a single OSOT total score.

Correlations

For this part of data analysis, all 242 subjects were included. The relationship between the OSOT total scores and the scores of FIM ADL, FIM Cognition, Brunnstrom total, and age were first examined by inspecting the scatterplot for linearity. These scatterplots are shown in Appendix B. As shown in these figures, the underlying relationship in each case is linear. Consequently, Pearson Product Moment correlation coefficients (Glass and Hopkins, 1984) were computed. The values for the OSOT total with each of the variables are reported in Table 5.

As shown in Table 5, the OSOT total correlated most highly with the FIM Cognition sub-scale items, ranging from .43 to .56. FIM Memory and FIM Comprehension were found to correlate highest and second highest respectively with the OSOT total. The correlation between FIM Comprehension and the OSOT total is supported by the theories described in Chapter II. In contrast, the correlation between the FIM Memory and the OSOT total is not well documented in the literature of occupational therapy.

The next highest correlations were the FIM items under ADL subscale, ranging from .29 to .54. Among the FIM ADL

Table 5

Correlation Coefficients of OSOT Total Score with Other Variables

Variable	Mean	SD	r	p
FIM Cognition	22.76	8.28	.56	.000
FIM comprehension	4.89	1.79	.55	.000
FIM expression	4.72	1.91	.43	.000
FIM social interaction	4.64	1.87	.45	.000
FIM problem solving	4.14	1.83	.53	.000
FIM memory	4.36	1.88	.56	.000
FIM ADL	58.43	20.52	.51	.000
FIM eating	5.24	1.11	.34	.000
FIM grooming	5.12	1.71	.51	.000
FIM bathing	3.60	1.50	.46	.000
FIM dressing upper	4.75	1.99	.54	.000
FIM dressing lower	4.02	2.28	.45	.000
FIM toileting	4.15	2.40	.46	.000
FIM bladder management	5.49	1.43	.44	.000
FIM bowel management	5.14	2.05	.37	.000
FIM bed/chair transfer	4.55	2.06	.45	.000
FIM toilet transfer	4.46	2.12	.47	.000

... cont'd

cont'd Table 5

Variable	Mean	SD	r	p
FIM tub transfer	4.11	1.96	.43	.000
FIM locomotion	4.81	1.79	.33	.000
FIM stairs	3.01	2.08	.29	.000
Brunnstrom Total	15.44	6.89	.23	.000
Brunnstrom arm	3.63	2.08	.24	.000
Brunnstrom hand	3.67	2.04	.19	.003
Brunnstrom leg	4.32	1.67	.24	.000
Brunnstrom foot	3.82	1.91	.17	.009
Demographics				
Age	69.17	12.62	.05	.443
Gender	1.45	0.50	-.02	.743
Medication Assist	1.49	0.71	.43	.000
CVA Location	1.10	0.31	.06	.392
CVA Type	1.82	0.39	.19	.003
CVA Side	1.07	0.50	.04	.551
Discharge Location	1.37	0.48	.00	.967

items, FIM Dressing Upper and FIM Grooming were found to correlate highest and second highest with the OSOT total. Clinically, it has been known to therapists and nurses that patients with perceptual impairment have greater difficulties in dressing and grooming. In fact, there are several studies documenting the relation between dressing problems and perceptual deficits (McNeny, 1983; Farver & Farver, 1982; McMenamin, 1976). This study not only confirmed these findings but also demonstrated that patients with high degrees of perceptual impairment were more dependent in grooming as well.

The lowest correlations were found for the Brunnstrom stages, ranging from .16 to .24. The correlations between the Brunnstrom stages and the OSOT total are quite low. The magnitude of these correlations implies that only about 4% of variance of the OSOT total is shared with that of the Brunnstrom stages. Therefore, it would appear that the low correlation between the Brunnstrom stages and the OSOT total should not be an evidence for refuting Hypothesis 2. Similarly, although CVA type is not expected to correlate with the OSOT total, a low correlation was found (.19). However, since the correlation was so low that it should not be considered as an evidence for refuting Hypothesis 2.

A significant correlation was found between Level of Medication Assist and the OSOT total (.43). Moreover, the following five variables did not correlate with the OSOT total score at .05 level of significance: age, gender, CVA location, CVA side, and discharge location. With respect to CVA location, although a correlation was expected, one was not obtained. As pointed out before, 76% of the brainstem strokes was occlusive in nature, which could have resembled cortical strokes in causing perceptual impairment as a result of the diffused effect of the stroke. Therefore the lack of correlation between CVA location and OSOT total should not be an evidence for refuting Hypothesis 2. Consequently, with the exception of discharge location, all the relationships between the OSOT total and the demographic variables support Hypothesis 2.

Chapter V

Discussion, Conclusions and Implications for Practice and Research

The purpose and procedures of this study are presented at the beginning of this chapter, followed by a summary of the findings. The limitations of this study are then presented. The conclusions drawn from the findings and taken into account the limitations are subsequently provided. Lastly, the implications for practice and the needs for future research are identified.

Summary of Study

The purpose of this study was to establish further evidence concerning the internal consistency and construct-related evidence of the revised OSOT. To address this purpose, data from the following instruments were administered to 242 stroke patients admitted to the Glenrose Rehabilitation Hospital from May 1993 through October 1994: the Ontario Society of Occupational Therapists Perceptual Evaluation (OSOT) (Boys,M., Fisher, P., Holzberg, C., and Reid, D.W., 1988), the Functional Independence Measure (FIM) (Linacre, Heinemann, Wright, Granger, & Hamilton, 1991), the Brunnstrom Stages of Motor Recovery (Brunnstrom stages) (Gowland et al., 1993). These instruments, which are routinely administered to all stroke patients admitted to the Hospital, assess perceptual impairment, functional independence, and motor recovery of hemiplegic limbs respectively. As well, demographic data were collected from the clinical records.

Item level data necessary to compute the internal consistency of the OSOT using Cronbach's alpha were available for 91 subjects. In contrast a full set of data was available to investigate the construct-related evidence of the OSOT. Correlat[illegible] between the OSOT total score and each of the FIM item[illegible] the FIM ADL and Cognition scores, the Brunnstr[illegible] score, and the demographic variables were comput[illegible]

Summary of Finding

Cronbach's alpha was found to be .89 which implied that the internal consistency of OSOT was quite high. Further, elimination of any one of the test items did not significantly increase the value for Cronbach's alpha value.

The correlations between OSOT total score and the following variables provide convergence evidence for validity of OSOT total score as an indicator of perceptual impairment: FIM ADL (r=.51), FIM Dressing Upper (r=.54), FIM Dressing Lower (r=.45), FIM Comprehension (r=.55), FIM Expression (r=.43) and Medication Assist (.43). At the same time, the lack of relation between the OSOT total score and the Brunnstrom stages, age, gender, and CVA type provide evidence of discrimination. However, there was one negative finding which contradict theoretical prediction, which is the lack of relation between the OSOT total score and discharge destination.

Limitations

This study was conducted in a single institution in Alberta. Further, all the subjects were stroke in-patients in a rehabilitation setting. The findings of this study may not be generalizable to other types of settings. Moreover, the findings may not be generalizable to other diagnostic groups (e.g. brain injury, neoplasm), which may have different profiles of perceptual impairment.

Another limitation is that there were only 91 out of the 242 OSOT forms available for computing the internal consistency of the OSOT using Cronbach's alpha. It was found that the mean FIM ADL and the mean FIM Cognition for those subjects with OSOT items were each significantly lower than the corresponding means for those without item scores (Table 3). In other words, the group of subjects with item scores were relatively more disabled than the group without item scores. The most plausible explanation is that there were relatively fewer perceptually normal subjects in the group with item scores than the group without item scores. Consequently, it is more difficult to generalize the finding that the internal consistency is high to less disabled and or perceptually normal stroke patients.

Conclusions

In light of the limitations identified above, the following conclusions were drawn from the results of this study. The value of Cronbach's alpha of the revised OSOT was .89. The value reported by Boys et al.(1991) was 0.9. Both of these values confirm that the current version of OSOT has good internal consistency for use with stroke patients with disability and perceptual impairment.

Boys et al. (1988) demonstrated the validity of OSOT for differentiating the neurologically normal from the perceptually impaired person. This study added further construct-related evidence to the OSOT. The findings of this study revealed that correlations between the OSOT total and the FIM, the Brunnstrom stages, and some of the demographic variables were congruent with the theoretical prediction, and therefore provided convergence and discrimination evidence to support the validity of OSOT total as an indicator of perceptual impairment.

Implications for Practice

1. The high internal consistency and the convergence and discriminability evidence gathered by this study support the use of OSOT total score as indicator of

perceptual impairment.

2. As described in the results of this study, it appears that a few number of the brainstem stroke patients in the study were incorrectly classified as perceptually impaired. It is speculated that the signs of brainstem stroke, such as ataxia and double vision, may have affected the accuracy of the patients' performance in some of the OSOT test items. Consequently, the patient was incorrectly classified as perceptually impaired. For this reason, when scoring patients' performance on the OSOT, clinicians should attend to the causes of the errors rather than solely the accuracy of the performance; since inaccuracy in test performance may be due to problems other than perceptual impairment. Similarly, it not desirable to have other people conduct the OSOT and then score the patient's performance without actually seeing how the patient performs.

Implications for Research

As described in Chapter II, the review of literature revealed that findings about the difference in frequency of perceptual impairment in right versus left hemispheric strokes were inconsistent; some researchers reported that perceptual impairment was more prevalent in right hemispheric stroke, others did not find a significant difference. In this study, the difference was also found to be not significant. It appears that the frequency of perceptual impairment in right versus left hemispheric strokes will remain as a research question to be answered.

Perception and memory have always been considered as essential parts of the mind in the field of psychology. However, the review of literature in the field of rehabilitation of stroke did not reveal any study directly addressing the relation between perceptual impairment and memory in stroke patients. Findings of this study preliminarily demonstrate that, as a group, patients with severe perceptual impairment have poorer memory than those who are less perceptually impaired. However, more research is needed to substantiate this finding.

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APPENDIX A

1. The original OSOT items before revision (Boys, et al., 1988).

2. The revised OSOT form (Boys et al., 1991).

3. The Functional Independence Measure (FIM) form (Linacre, J.M., Heinemann, A.W., Wright, B.D., Granger, C.V., & Hamilton, B.B., 1991).

4. Brunnstrom Stages of Motor Recovery: Arm/Hand & Leg/Foot (Gowland, et al., 1993).

The original OSOT items before revision (Boys et al., 1988)

Sensory Function

* Light touch
* Localization (A)
* Pressure
* Localization (B)
* Pain
  Proprioception
* Two-point discrimination
* Tactile suppression
  (R) Stereognosis
  (L) Stereognosis

Scanning Function

Scanning
Spatial Neglect

Apraxia

Motor Planning
* Ideomotor apraxia
* Ideational apraxia
  Copying 2-D designs
  Copying 3-D designs

Body Awareness

Body Puzzle
* Parts Recognition
  Draw-a-person

Spatial Relations

R/L Discrimination
Clock
Peg Board
Draw-a-house

Visual Agnosia

Shape Recognition
Colour Recognition
Size Recognition
Figure-Ground Discrimination

Note: Items not included in the revised OSOT (Boys et al, 1991) are marked with an asterisk.

SCORE SHEET

Name: ______________________ Date of Birth: ______________

Diagnosis ______________________ Date of Onset: ______________

Visual Status: ______________________

Education Level Attained: Elementary ________ Secondary ________ Post Secondary ________

Hand Dominance: ____________ Test Date: ____________ Examiner: ____________

Gender: M ________ F ________

	4	3	2	1	0	COMMENTS
1. Scanning						
2. Spatial Neglect						
3. Motor Planning						
4. Copying 2-D Designs						
5. Copying 3-D Designs						
6. Body Puzzle						
7. Draw-a-Person						
8. R/L Discrimination						
9. Clock						
10. Peg Board						
11. Draw-a-House						
12. Shape Recognition						
13. Colour Recognition						
14. Size Recognition						
15. F-G Discrimination						
16. Proprioception						
17. Stereognosis R.						
18. Stereognosis L.						
Total Score						= ________ of a possible 72

DEGREE OF IMPAIRMENT:

70-72 Within normal limits ________

61-69 Borderline (requires additional testing) ________

51-60 Mild ________

41-50 Moderate ________

40 or below Severe ________

FUNCTIONAL INDEPENDENCE MEASURE

FIM

LEVELS		
	7 Complete Independence (Timely, Safely 6 Modified Independence (Device)	NO HELPER
	Modified Dependence 5 Supervision 4 Minimal Assist (Subject = 75%+) 3 Moderate Assist (Subject = 50%+) Complete Dependence 2 Maximal Assist (Subject = 25%+) 1 Total Assist (Subject = 0%+)	HELPER

	ADMIT	DISCHG	FOL-UP
Self Care			
A. Eating			
B. Grooming			
C. Bathing			
D. Dressing-Upper Body			
E. Dressing-Lower Body			
F. Toileting			
Sphincter Control			
G. Bladder Management			
H. Bowel Management			
Mobility			
Transfer:			
I. Bed, Chair, Wheelchair			
J. Toilet			
K. Tub, Shower			
Locomotion			
L. Walk/wheel Chair	w c	w c	w c
M. Stairs			
Communication			
N. Comprehension	a v	a v	a v
O. Expression	v n	v n	v n
Social Cognition			
P. Social Interaction			
Q. Problem Solving			
R. Memory			
Total FIM			

NOTE: Leave no blanks; enter 1 if patient not testable due to risk.

Neurology Assessment
Motor Recovery
Brunnstrom Scoring

ARM

R L

☐ ☐ 1. not yet stage 2

☐ ☐ 2. resistance to passive shoulder abduction or elbow extension
☐ ☐ facilitated elbow extension
☐ ☐ facilitated elbow flexion

☐ ☐ 3. touch opposite knee
☐ ☐ touch chin
☐ ☐ shoulder shrugging > 1/2 range

☐ ☐ 4. extension synergy, then flexion synergy
☐ ☐ shoulder flexion to 90°
☐ ☐ elbow at side, 90° flexion: supination, then pronation

☐ ☐ 5. flexion synergy, then extension synergy
☐ ☐ shoulder abduction to 90° with pronation
☐ ☐ shoulder flexion to 90°: pronation then supination

☐ ☐ 6. hand from knee to forehead 5 x /5 sec.
☐ ☐ shoulder flexion to 90°: trace a figure 8
☐ ☐ raise arm overhead with full supination

☐ ☐ 7. clap hands overhead, then clap hands behind back 3 x /5 sec.
☐ ☐ shoulder flexion to 90°: scissor in front 3 x /5 sec.
☐ ☐ elbow at side, 90° flexion: resisted shoulder external rotation

R L
☐ ☐ STAGE OF ARM

HAND

R L

☐ ☐ 1. not yet stage 2

☐ ☐ 2. positive Hoffman
☐ ☐ resistance to passive wrist or finger extension
☐ ☐ facilitated finger flexion

☐ ☐ 3. wrist extension > 1/2 range
☐ ☐ finger/wrist flexion > 1/2 range
☐ ☐ supination, thumb in extension: thumb to index finger

☐ ☐ 4. finger extension, then flexion
☐ ☐ thumb extension > 1/2 range, then lateral prehension
☐ ☐ finger flexion with lateral prehension

☐ ☐ 5. finger flexion, then extension
☐ ☐ pronation: finger abduction
☐ ☐ opposition of little finger to thumb

☐ ☐ 6. pronation: tap index finger 10 x /5 sec.
☐ ☐ pistol grip: pull trigger, then return
☐ ☐ wrist and finger extension with finger abduction

☐ ☐ 7. thumb to finger tips, then reverse 3 x /12 sec.
☐ ☐ bounce a ball 4 times in succession, then catch
☐ ☐ pour 250 ml. from 1 litre pitcher, then reverse

R L
☐ ☐ STAGE OF HAND

Adapted from: Chedoke-McMaster, Motor Impairment Scale, C. Gowland et.al., 1993

LEG

R L

☐ ☐ 1. not yet stage 2

2. Crook lying:

☐ ☐ resistance to passive hip or knee flexion

☐ ☐ facilitated flexion

☐ ☐ facilitated extension

☐ ☐ 3. abduction: adduction to neutral

☐ ☐ hip flexion to 90°

☐ ☐ full extension

☐ ☐ 4. hip flexion to 90° then extension synergy

☐ ☐ bridging hips with equal weightbearing

Sitting:

☐ ☐ knee flexion beyond 100°

5. Crook lying:

☐ ☐ extension synergy, then flexion synergy

Sit:

☐ ☐ raise thigh off bed

Stand:

☐ ☐ hip extension with knee flexion

6. Sit:

☐ ☐ lift foot off floor 5 x /5 sec.

☐ ☐ full range internal rotation

Stand:

☐ ☐ trace a pattern: forward, side, back, return

7. Stand:

☐ ☐ unsupported: rapid high stepping 10 x /5 sec.

☐ ☐ trace a pattern quickly; forward, side, back, reverse

☐ ☐ on weak leg with support: hop on weak leg

R L

☐ ☐ STAGE OF LEG

FOOT

R L

☐ ☐ 1. not yet stage 2

2. Crook lying:

☐ ☐ resistance to passive dorsiflexion

☐ ☐ facilitated dorsiflexion or facilitated toe extension

☐ ☐ facilitated plantarflexion

3. Supine:

☐ ☐ plantarflexion > 1/2 range

Sit:

☐ ☐ some dorsiflexion

☐ ☐ extension of toes

☐ ☐ 4. some eversion

☐ ☐ some inversion

☐ ☐ legs crossed: dorsiflexion, then plantar flexion

☐ ☐ 5. legs crossed: toe extension with ankle plantarflexion

☐ ☐ sitting with knee extended: ankle plantarflexion, then dorsiflexion

Stand:

☐ ☐ heel on floor: eversion

☐ ☐ 6. heel on floor: tap foot 5 x /5 sec.

☐ ☐ heel off floor: foot circumduction

☐ ☐ knee straight, heel off floor: eversion

☐ ☐ 7. heel touch forward, then reverse to toe touching behind 5 x /10 sec.

☐ ☐ circumduction quickly, reverse

☐ ☐ up on toes, then back on heels 5x

R L

☐ ☐ STAGE OF FOOT

Adapted from: Chedoke-McMaster, Motor Impairment Scale, C. Gowland et.al., 1993

APPENDIX B

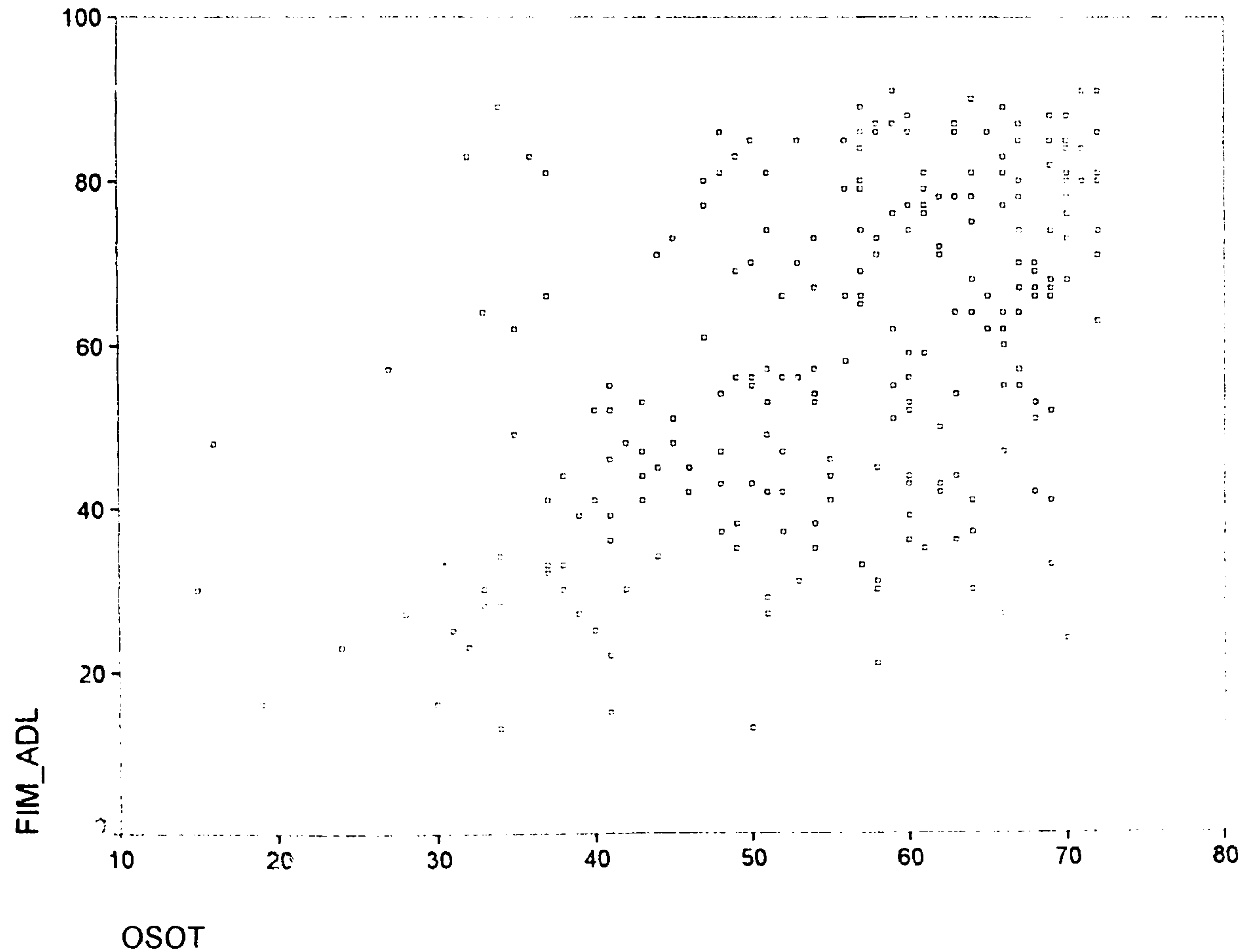
1. Scatterplot of FIM ADL score by OSOT score.

2. Scatterplot of FIM Cog. score by OSOT score.

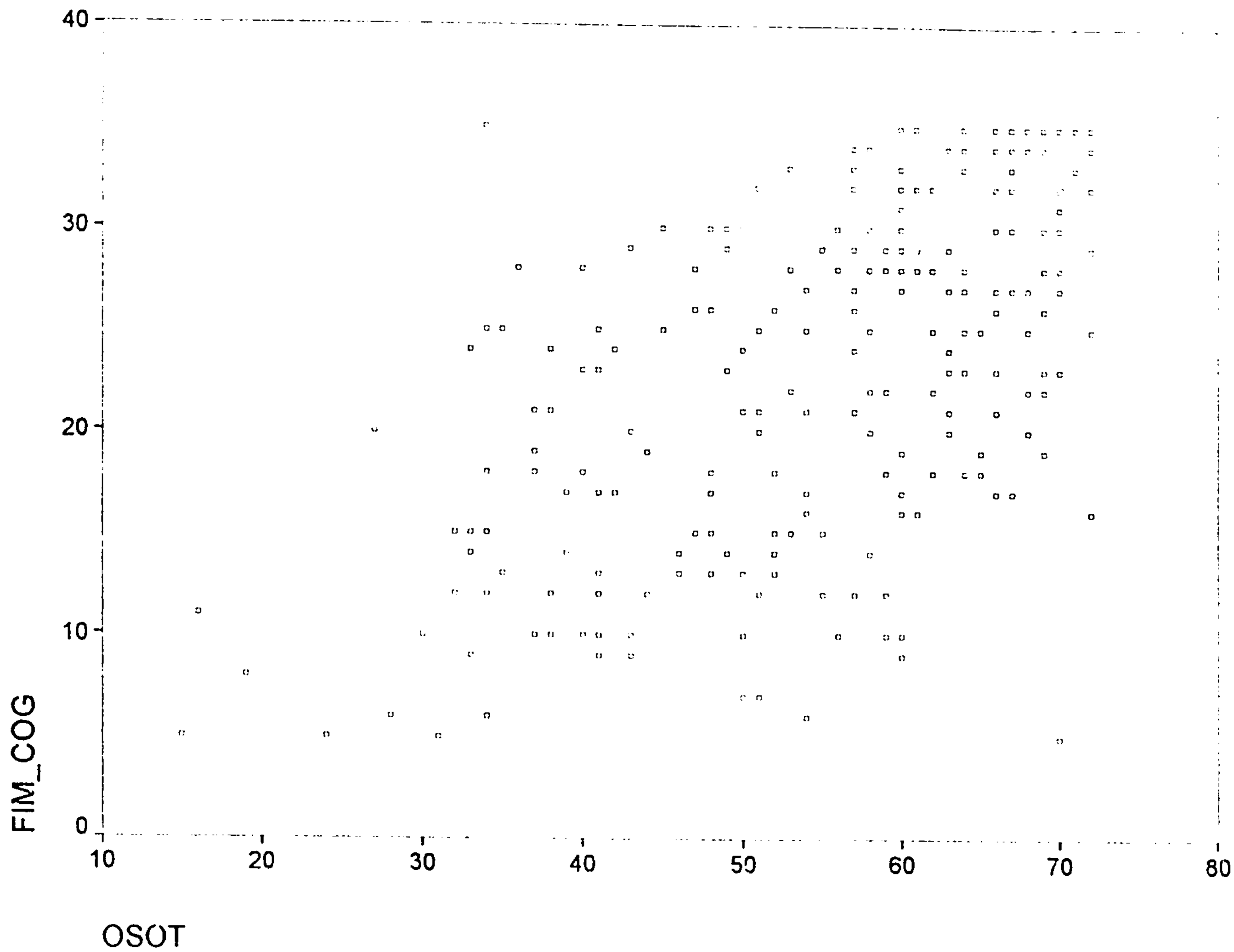
3. Scatterplot of Brunnstrom total score by OSOT score.

4. Scatterplot of Age by OSOT score.

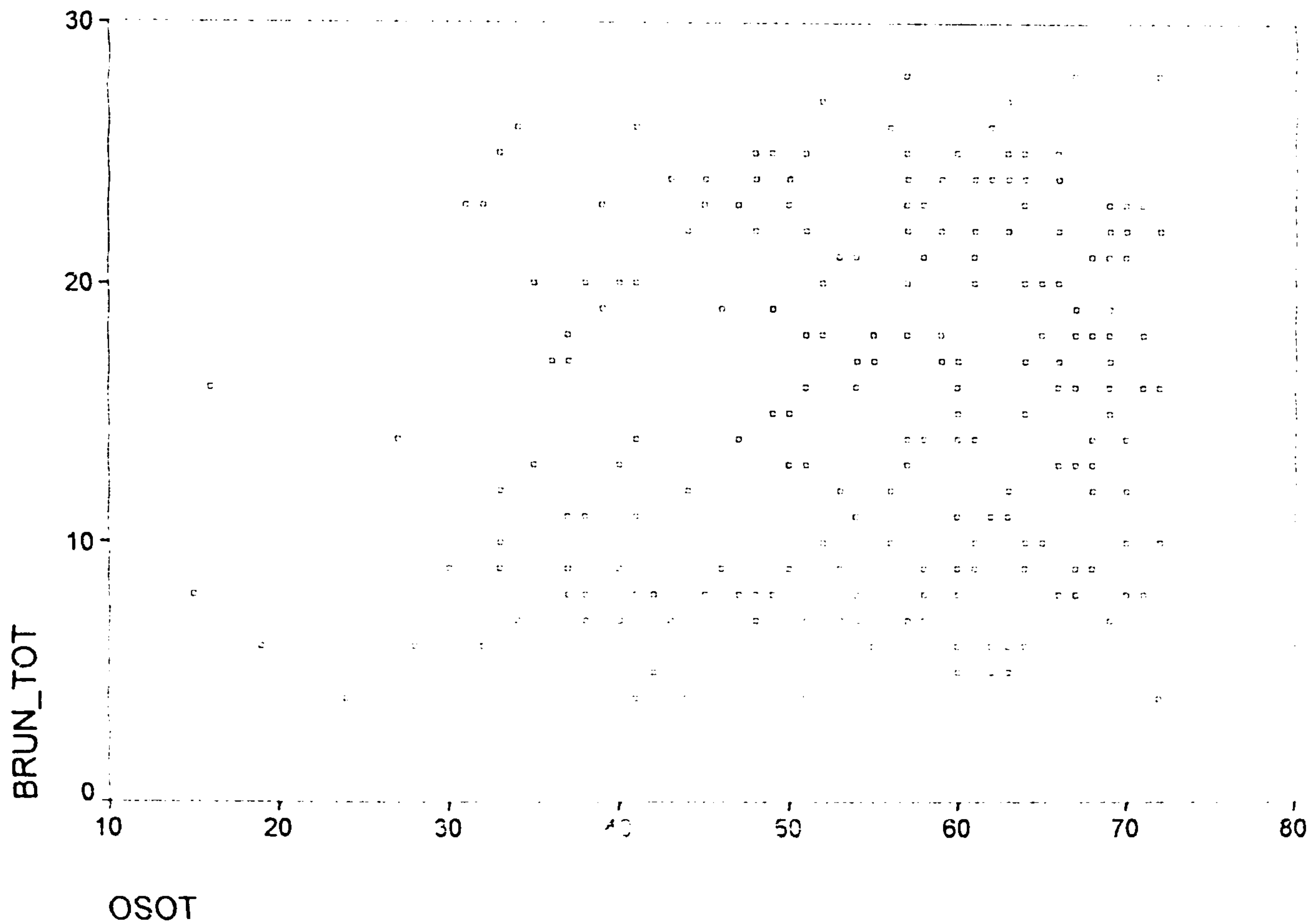
Scatterplot of FIM ADL score by OSOT score



Scatterplot of FIM COG score by OSOT score



Scatterplot of Brunnstrom total score by OSOT score



Scatterpl^t of AGE by OSO^ score