Note: Prefer platform presentation, but will accept poster session.

Type of impairment and magnitude of injury from a traumatic brain injury (TBI) are determined by initial injury severity, location of brain lesion(s), depth of coma, age, education, and length of post-traumatic amnesia (PTA) (Davis, 2000a; 2000b; Kersel, Marsh, Havill, & Sleigh, 2001; Sherer et al., 2002). PTA duration is considered the best measure for predicting cognitive, neurological, and functional outcome following injury (Ahmed, Bierely, Sheikh, & Date, 2000; Artiola et al., 1980; Bishara, Partridge, Godfrey, & Knight, 1992; Brooks, Aughton, Bond, Jones, & Rizvi, 1980; McFarland, Jackson, & Geffen, 2001; Tate, Perdices, Pfaff, & Jurjevic, 2001). PTA is "the period from the time the patient regains consciousness but is still in a disoriented and confused state until the time the patient's memory for ongoing events becomes reliable and accurate" (Murdoch & Theodorus, 2001, p. 4). PTA interferes with resumption of cognitive skills to former levels, disrupting attention, perception, memory, and executive functioning (Gillis, 1996). These deficits have adverse effects on communicative competence (McGann, Werven, & Douglas, 1997), resulting in linguistic, paralinguistic and extra-linguistic pragmatic deficits (Kennedy & Deruyter, 1991), being the most chronic communication impairments associated with TBI (Sohlberg & Mateer, 2001).

PTA duration depends on extensiveness of injury (Ahmed et al., 2000); individuals sustaining severe TBIs with longer PTA remain in acute settings longer and enter rehabilitation later than those with less severe injuries and shorter PTA (Tate et al., 2001). PTA is highly correlated with length of time to reach maximum recovery (Jones & Long, 1990). However, PTA duration has varying cognitive impact depending upon time post-injury (Adamovich & Henderson, 1985; 1997; Glisky & Delaney, 1996; Millis et al., 2001).

TBI studies on pragmatics have focused on monologue and conversation (Coelho, Liles, & Duffy, 1991a; 1991b; 1995; Ehrlich, 1988; Galski, Tompkins, & Johnson, 1998; Hartley & Jensen, 1991; McDonald & Pearce, 1995; Mentis & Prutting, 1987; 1991; Snow, Douglas & Ponsford, 1995). PTA duration has been examined relative to cognitive outcome (Brooks et al., 1980; McFarland, Jackson, & Geffen, 2001; Wilson et al., 1999). Minimal research has explored PTA relative to pragmatic competence (Snow, Douglas, & Ponsford, 1997; 1998), especially long-term outcome and persisting pragmatic deficits.

This study investigated PTA duration relative to its effect on linguistic and nonlinguistic pragmatics in moderate-to-severely impaired TBI adults. Pragmatic skills were measured by Revised Edinburgh Functional Communication Profile (REFCP) (Wirz, Skinner, & Dean, 1990) and examined relative to PTA duration, pre-morbid IQ, mental status, and cognitive severity.

Method

Ten adults suffering moderate-to-severe TBI resulting from MVAs participated. Criteria included: males (age 18 to 45); head injury severity determined by Glasgow Coma Score (GCS) (Teasdale & Jennett, 1974) of $\leq$ 12 or Rancho Los Amigos Scale (Hagan, Malkmus, & Durham, 1979) of $\leq$ 4; native English speakers; right-handedness; post injury period between 6 months and 6 years to explore long-term outcome; initial PTA post-injury period exceeding 24 hours; positive CT scan at time of injury (Table 1). The study was gender specific to control for varying pragmatics among genders.

Pre-experimental testing (Table 2) included Galveston Orientation and Amnesia Test (GOAT) (Levin, O'Donnell, & Grossman, 1979) as control for absence of PTA; current scores indicated normal consciousness and post PTA status. All participants passed a hearing screening (ASHA, 1996). The Mini Mental Status Examination (MMSE) (Folstein, Folstein, & McHugh,

1975) and Scales of Cognitive Ability for Traumatic Brain Injury (SCATBI) (Adamovich & Henderson, 1992) were administered to determine cognitive status. Pre-morbid intelligence (IQ) (Table 3) was determined via demographic quotient (Barona, Reynolds, & Chastain, 1984).

The REFCP (Wirz et al., 1990) was used for examining pragmatic skills. It measures communicative linguistic and nonlinguistic performance, allowing analysis of conversational interaction with the examiner. Two profiles, Interaction Analysis (IA) and Communicative Performance Analysis (CPA) are obtained. IA assesses ability to engage in/sustain interaction, requiring 10 conversational exchanges. Examiner determines participant effectiveness in conversational exchanges (REFCP-CE) and modalities used. CPA is based on informal communication: participant enters a quiet room, obtains examiner's attention, and plays an UNO game while naturally communicating verbally/nonverbally. Examiner evaluates communication on 3 dimensions: examiner acknowledgment, communication effectiveness (REFCP-CF); and modality used (REFCP-MOD).

The three measurements were averaged for a total score (REFCP-TOT). Responses were videotaped using a Sony Digital Camcorder.

Results

Score distribution for primary variables were explored via box-plots. Figure 1: participant distribution of PTA duration. Figure 2: pragmatic scores (REFCP scaled scores), characterized by four values: linguistic pragmatic abilities or conversational exchange efficiency (REFCP-CE); nonlinguistic pragmatic abilities (REFCP-MOD); speech act efficiency (REFCP-CF); average of the three scores (REFCP-TOT). Figure 3: pre-morbid IQ (verbal, performance, and full scale quotients). Figure 4: mental status (MMSE). Figure 5: cognitive severity (SCATBI standard scores; SCATBI reasoning subtest scores). REFCP scores are in Table 4.

Relationships among variables were examined via linear patterns and Pearson Product-Moment correlations at alpha level .05. In assessing relationships between PTA duration, pre-morbid IQ, and overall pragmatic abilities, there was no strong linear pattern or significant correlation between PTA and REFCP-TOT. There also was no strong linear relationship or significant correlation between IQ and REFCP-TOT.

Analyses of PTA duration, pre-morbid IQ and linguistic pragmatic abilities (IA) revealed no strong linear pattern or significant correlation between PTA and REFCP-CE. There also were no linear relationships or significant correlations found between IQ and linguistic pragmatics.

Relationships between PTA duration, pre-morbid IQ, and nonlinguistic pragmatic abilities (CPA) (REFCP-CF/MOD) revealed a significant negative correlation between PTA and nonlinguistic pragmatics ($r = -.685$, $p = .039$). However, there was no linear pattern or significant correlation between IQ and nonlinguistic pragmatics.

Relationships between PTA duration, pre-morbid IQ, MMSE, and SCATBI standard scores revealed no significant correlations between PTA or IQ and MMSE. No significant relationships were found between PTA and SCATBI or between PTA and IQ. A significant negative correlation was found between Performance IQ and SCATBI ($r = -626$, $p = .053$)

Discussion

The purpose of this study was to determine whether PTA duration was related to linguistic and nonlinguistic pragmatic skills in chronic TBI. Pre-morbid IQ and cognitive performance also were investigated relative to PTA duration. Results revealed a significant negative relationship between PTA and nonlinguistic pragmatics, indicating that the longer an individual initially was in PTA, the lower their current nonlinguistic scores on the REFCP. Behaviors exhibited included reduced eye contact and prolonged silence. These behaviors may

have resulted from disrupted information processing and diminished attention, often considered contributing factors to apragmatic social skills in TBI. No other significant findings were observed between REFCP and PTA or between other variables and PTA or REFCP.

PTA duration was not significantly related to linguistic pragmatic abilities. Participants were similar in social background, education, age, and injury severity, possibly impacting reduced score variability in pragmatic linguistic and cognitive performance and IQ. Extended time post-injury may have had an influence on improvements in linguistic pragmatic skills; most participants were greater than one year post-injury (Millis et al, 2001). Thus, PTA duration may not be a useful measure for linguistic pragmatic skill outcome once an individual is beyond 6 months post injury. Length of PTA, however, appeared to relate to outcome for nonlinguistic pragmatic skills. Thus, PTA duration may be useful in predicting long-term outcome of some components of communicative competence. The current findings support observations that TBI individuals exhibit nonlinguistic indicators of lack of insight and denial of deficits indefinitely, years after injury (Adamovich & Henderson, 1985; 1997; Hartley, 1995; Millis et al., 2001).

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Table 1. Participant Characteristics

	Age	Education*	GCS+	Rancho**	TPI++	PTA***
1-	21	12	3	3	45	120
2-	28	12	2	N/A	7	4
3-	31	13	3	N/A	74	14
4-	22	12	3	2	22	270
5-	24	10	3	N/A	25	450
6-	36	12	3	N/A	30	180
7-	30	14	3	N/A	10	5
8-	35	12	3	N/A	49	360
9-	39	12	N/A	3	38	780
10-	28	13	3	4	17	120
Range	21-39	10-14	2-3	2-4	7-74	4-780
Mean	29.5	12.2	2.9	3.0	31.7	230.3
S.D.	6.04	1.03	.33	.82	20.40	245.96

* years

\+ Glasgow Coma Scale (GCS) score at time of injury

** Rancho Los Amigos Levels of Cognitive Function rating at time of injury

++ Time post-injury (months) at time of investigation

*** PTA duration (days) as measured by GOAT at time of injury

Table 2. Pre-experimental Test Data

	GOAT*	MMSE+	SCATBI SS**	SCATBI Reasoning++
1-	87	27	107	109
2-	90	30	112	104
3-	91	25	89	95
4-	78	23	88	92
5-	86	25	90	92
6-	89	27	125	120
7-	92	27	118	118
8-	76	25	92	94
9-	76	25	99	89
10-	76	20	86	91
Range	76-92	20-30	86-125	89-120
Mean	84.10	25.40	100.60	100.40
S.D.	6.79	2.68	14.00	11.60

* Galveston Orientation and Amnesia Test current scaled scores

+ Mini Mental Status Examination scaled scores

** Scales of Cognitive Ability for Traumatic Brain Injury standard scores

++ Scales of Cognitive Ability for Traumatic Brain Injury reasoning subtest standard scores

Table 3. Premorbid Intelligence Quotients

	Verbal*	Performance+	Full Scale**
1-	99.41	99.98	100.36
2-	95.41	96.54	95.81
3-	104.02	102.50	103.26
4-	98.28	98.44	98.47
5-	94.27	97.15	95.2
6-	89.77	90.36	89.68
7-	99.27	95.68	98.32
8-	95.02	94.11	94.70
9-	95.02	94.11	94.70
10	101.41	102.17	104.92
Range	89.77 – 104.02	90.36 – 102.50	89.68 – 104.92
Mean	97.2	97.1	97.6
S. D.	4.10	97.1	97.6

Figure 1. Distribution of PTA Duration (days)

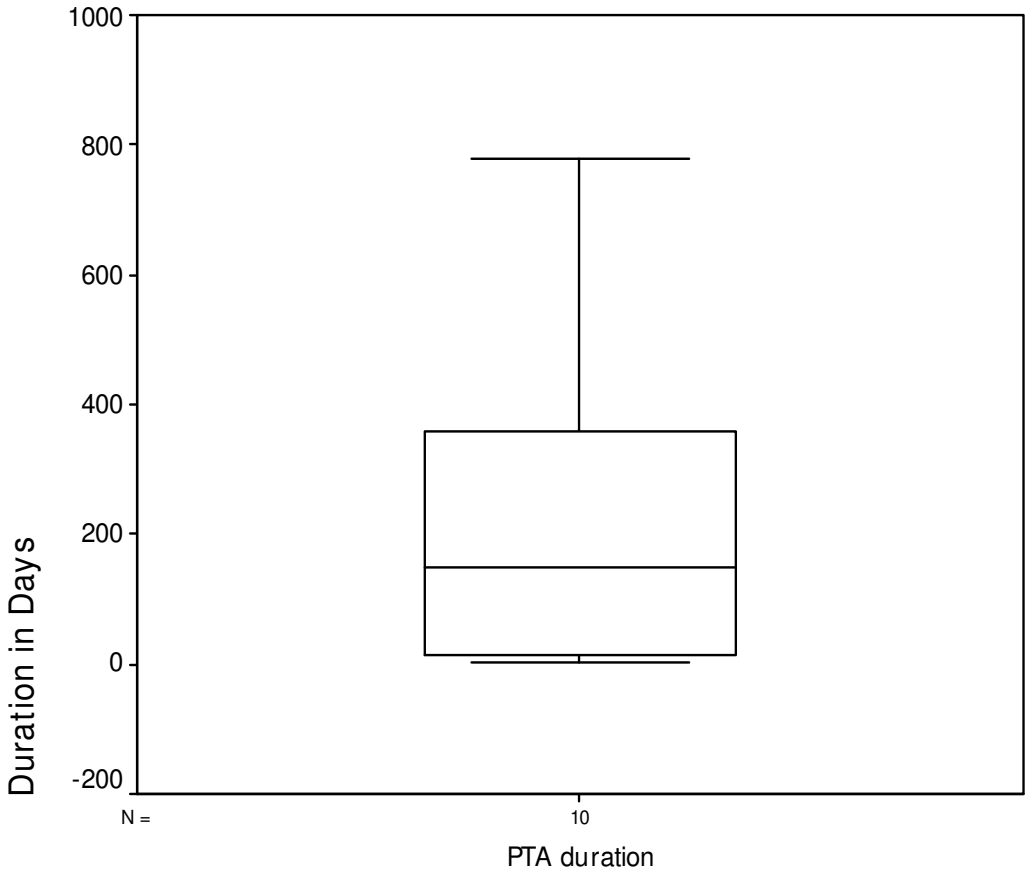

Figure 2. Distribution of REFCP Scores

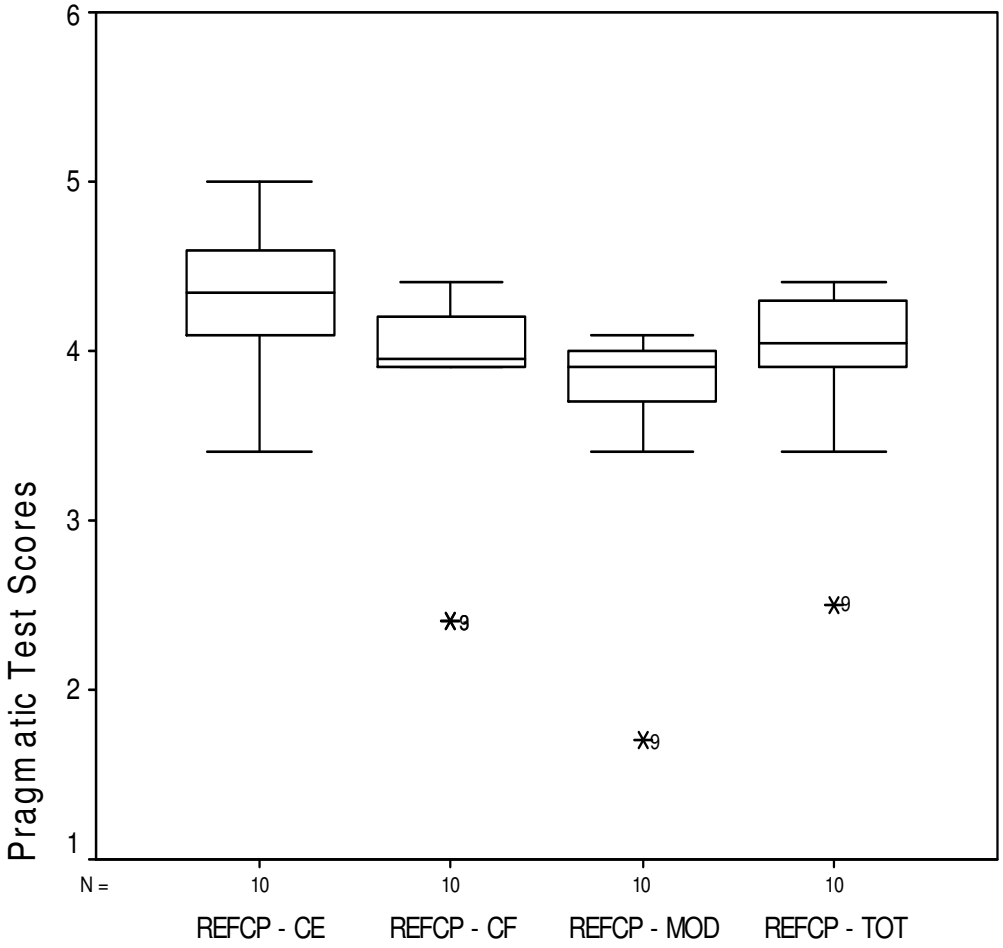

Figure 3. Distribution of Premorbid IQ Scores

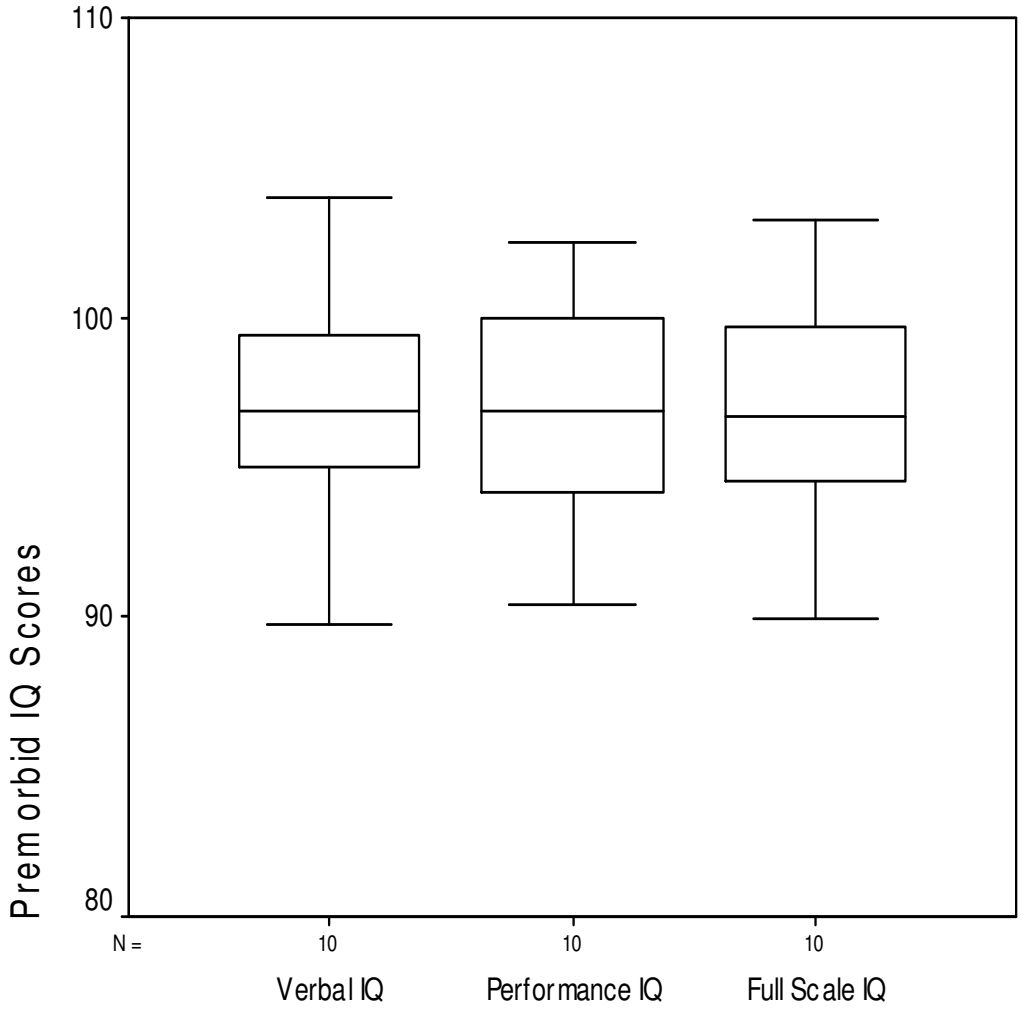

Figure 4. Distribution of MMSE Scores

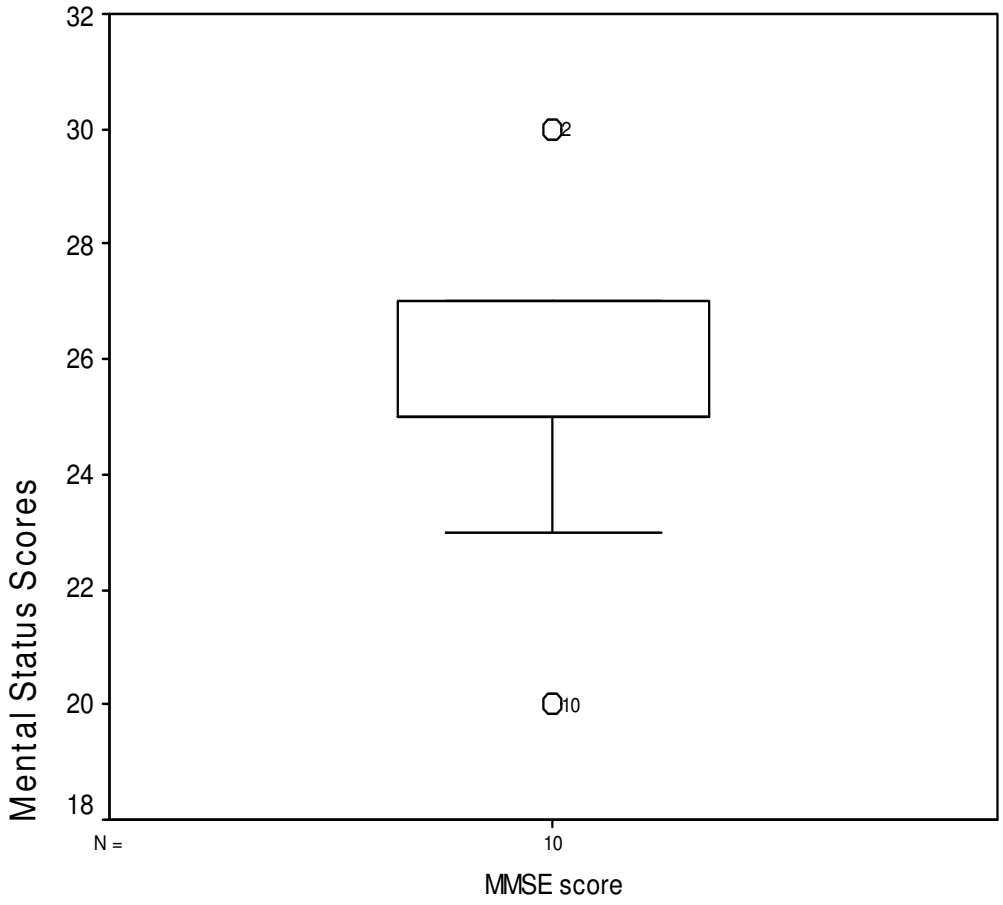

Figure 5. Distribution of SCATBI Scores

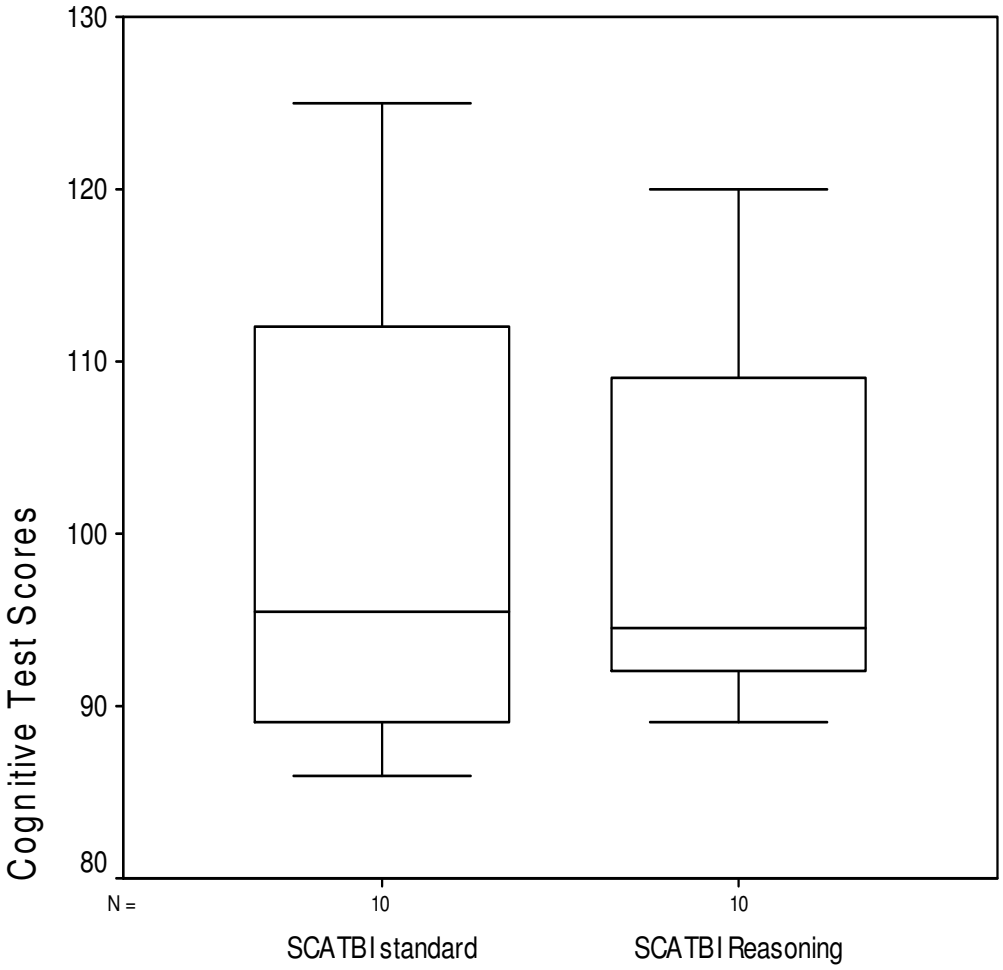

Table 4. Revised Edinburgh Functional Communication Profile Scores

	REFCP CE*	REFCP CF+	REFCP MOD**	REFCP TOT++
1-	4.3	4.0	3.9	4.1
2-	4.4	3.9	3.7	4.0
3-	4.3	2.4	3.4	3.4
4-	4.0	3.9	3.9	3.9
5-	4.6	4.1	4.0	4.2
6-	4.6	4.4	4.1	4.4
7-	4.1	3.9	3.8	3.9
8-	5.0	4.2	3.9	4.4
9-	3.4	2.4	1.7	2.5
10-	4.8	4.2	4.0	4.3
Range	3.4-5.0	2.4-4.4	1.7-4.1	2.5-4.4
Mean	4.4	3.7	3.6	3.9
S.D	.45	.73	.71	.58

* = Conversational exchange efficiency scaled score

+ = Communicative function efficiency scaled score

** = Modality efficiency scaled score

++ = Total average scaled score