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Severe Traumatic Head Injury and Social Behaviour: A Review*

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Studies examining social behaviour and adjustment following severe traumatic head injury are reviewed. In contrast to the consistent finding of impaired social adjustment and personality change following severe head injury in uncontrolled studies, four controlled follow-up studies provide equivocal evidence of impaired social functioning relative to control subjects. Injury severity correlates negatively with social adjustment post-injury but not with personality change, which reflects interpersonal social behaviour. It is suggested that impairment in social behaviour following severe head injury may be mediated by impaired cognitive ability. Methodological issues relating to follow-up research in this area are discussed and suggestions for future research made.

Head injury has been described as an "unpreventable epidemic" (Selecki, 1981), and it is estimated that in the 15 to 24 age group, one male in 27 attends hospital each year with a head injury. Recent studies examining the psychological effects of severe head injuries (SHI) have focused on assessing psychosocial adjustment (Katz & Lyerly, 1963) after injury. Psychosocial adjustment has been identified as the most significantly impaired area of functioning following SHI (Oddy, Coughlan, Tyerman, & Jenkins, 1985; Weddell, Oddy, & Jenkins, 1980). In particular, change in personality has been reported to be a common consequence of SHI, and is associated with the burden experienced by relatives (Brooks, Campsie, Symington, Beatie, & McKinlay, 1986; Brooks & McKinlay, 1983; McKinlay, Brooks, Bond, Marinage, & Marshall, 1981).

This article reviews studies examining social functioning in an attempt to examine three fundamental issues that have implications for current clinical practice and future research on SHI: The effect of SHI on social functioning, the identification of pre-injury and injury-related factors predictive of social functioning following SHI, and the identification of factors associated with social functioning following SHI. Researchers have been reluctant to define head injury and there are no agreed minimum criteria for diagnosis. This review will include research employing adults who have suffered a traumatic injury to the head that has resulted in a post traumatic amnesia (PTA) of one day or greater (defined as severe by Jennet & Teasdale, 1981) and will include both open (compound fracture or penetrating) and closed head injuries.

Effects of Severe Head Injury on Social Functioning

The majority of studies examining psychosocial adaptation in SHI individuals report uncontrolled assessments without reference to level of premorbid functioning. This is a problem because SHI is largely restricted to males under 30 years of age, who may have

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impaired social functioning prior to injury (Brooks, 1984a). Two strategies have been adopted to control for premorbid psychosocial adjustment. The first is to obtain retrospective data on the social functioning of the SHI individual (Oddy, Humphrey, & Uttley, 1978a) from relatives, employers, or friends. Unfortunately, the collection of retrospective data may be subject to bias resulting in an unduly positive evaluation of premorbid functioning, particularly when relatives are used as a data source (e.g., Brooks, & McKinlay, 1983). A second approach is to include a matched control group (often peers or siblings of the SHI individual), who are likely to be functioning at a similar level to that of the SHI adults prior to injury. This approach is more appealing than the first, but requires careful matching of groups, and does not allow one to ascribe with confidence any differences in group functioning to neurological damage. For example, it remains possible that some other factor, such as the effect of having experienced a life threatening disorder, may be sufficient to account for some or all of the difference between groups. The valid attribution of change in social behaviour or adjustment to neurological damage may be increased by including a control group who have been similarly affected by accident or illness but suffered no neurological damage. Finding a control group matched on all relevant demographic, social and medical (non-neurological) factors is, however, difficult.

When reviewing studies examining social functioning following SHI, we were surprised to find only four which have included control groups. Oddy, Humphrey, and Uttley (1978b), compared a consecutive series of 50 head injured adults with 35 orthopaedic controls. The SHI subjects were divided into those with a PTA of greater than seven days and those with a PTA of 1-7 days. The head injured group was young, 80% being under 25 years of age, and was matched with an orthopaedic control group for age and socioeconomic status. Both groups were assessed by means of relative or spouse ratings of premorbid and post-injury social functioning (assessed six and 12 months after the injury). Eight variables were derived from the assessment: Job satisfaction, impairment of leisure activities, boredom, social contact, friction with relatives or in-laws, frequency of contact with parents or in-laws, dependence on parents, and subjective symptoms. Only on the subjective complaints measure did both SHI groups perform significantly more poorly than the control group.

The SHI group with PTA of seven days or more duration were found to be more bored and to have less social contact at six months post-injury. Interestingly, both the SHI group with a PTA of seven days or greater and the orthopaedic control group were more impaired than the SHI group with PTA's of 1-7 days on the job satisfaction and leisure activities measures. This raises the possibility that non-neurological factors could account for impairment on these variables. Their finding of no significant between group differences on the two family functioning variables, and of impaired performance by the control group (relative to the SHI group with PTA's of 1-7 days) on two of the eight variables provides only equivocal evidence of impairment in social adjustment following severe closed head injury. Oddy and Humphrey (1980) report further follow-ups of these groups at 12 and 24 months post-injury. The SHI groups were reported as leaving home on fewer social outings than the orthopaedic controls but no other comparisons with the controls were reported. Once again, limited evidence for impaired social adjustment emerged.

In the only study to focus on the actual social behaviour of SHI patients, Newton and Johnson (1985) compared 11 patients with head injuries (penetrating and non-penetrating) who were attending a day centre for the physically handicapped, with 20 socially unskilled outpatients, and 32 subject panel recuruits. The head injured group were extremely severely injured having been unconscious for an average of 11.4 weeds. The socially unskilled control group were a consecutive series of referrals to a psychology clinic, with psychotic patients excluded. This group was included to control for the possibility of impaired premorbid social functioning in the SHI adults. The control groups included a higher proportion of females and had a younger mean age than the SHI group (28.4 versus 34.8 years). The SHI group was assessed at an average post-injury interval of 5.4 years (range = 1-13 years) on the following measures of social functioning: The Katz

Adjustment Scale (KAS), global behavioural ratings of social performance, social anxiety and assertiveness, behavioural ratings of skill during an opposite sex interaction, the Fear of Negative Evaluation Questionnaire, and the Social Anxiety and Distress Scale (Watson & Friend, 1969). Other measures included the Rosenberg Self-Esteem Scale (Rosenberg, 1965), the Neurophysical Scale (Bond, 1975), and the Wechsler Adult Intelligence Scale (Wechsler, 1955). On the KAS, the SHI group were rated as more impaired that the subject recruit panel control group on eight of the 16 subscales. The SHI group was rated as less impaired on 4 subscales and more impaired on one subscale, suggesting that the SHI group had a higher level of social adjustment than the outpatient controls. The two behavioural measures of social performance during the opposite sex interaction indicated impairment relative to both control groups, although no significant group differences were found for the global ratings of assertiveness and social anxiety. The SHI group rated themselves as less socially anxious on the self-report social anxiety measures than the outpatient controls. In summary, the SHI group was found to be functioning more poorly than the subject panel recruits on three of the seven measures of social functioning, to be functioning more poorly than the outpatient controls on two of the seven measures, and to be functioning at a higher level than the outpatient controls on three of the seven measures. The difference in functioning between the subject group recruits and the SHI panel may be due to demographic differences. As was the case with the Oddy et al. (1978b; 1980) study, when comparison is made with another patient group, the evidence for an impairment of social adjustment or behaviour specific to neurological damage becomes less impressive.

A somewhat different approach to assessing the impact of SHI on social adjustment was adopted by Rosenbaum and Najenson (1976). They obtained ratings made by wives of their spouses' current functioning, their own current functioning, and changes in current family life on a questionnaire designed to assess four areas: Family activities, social relations, marital roles, and mood disturbance. The 10 SHI army personnel included were described as being severely injured, eight with penetrating wounds and three with closed head injuries. Ratings were compared with those made by the wives of six paraplegics and 14 (out of the 30 approached) control wives who were all paramedics. The wives were matched for age across the three groups, and the assessments were completed twelve months post-injury. The wives of the SHI group reported changes in family activities and the social behaviour of their spouses that were not found for the control groups. These changes included responsibility for household duties, interactions with children, sexual functioning, leisure activities, and husbands' childish behaviour. These changes were rated as being distressing to the wives. Expected marital roles were similar for the three groups, however, significant differences between the wives of the SHI and the control groups were found for actual marital roles. For example, wives of the head injured individuals had increased responsibility for dealing with family matters outside the home. Finally, the wives of the SHI individuals had significantly more mood disturbance than the control groups.

Thus, it appears that a SHI to a male spouse is associated with significant changes in the family functioning as perceived by wives, and may result in mood disturbance in the wives. This study also found no significant differences between the paramedic and paraplegic group, which suggests that the changes in the SHI group's functioning was due to neurological damage rather than to experiencing an accident *per se*. It is worth noting, however, that the small number of paraplegic controls lessens the likelihood of finding statistically significant group differences and most of the means of the social adjustment variables were lower for the paraplegic group than the paramedical control groups. It is difficult to determine why this study found stronger evidence of impairment than the previously described studies. It may be that the group had more severe brain injury or that penetrating wounds produce greater social impairment than closed head injuries. Alternatively, obtaining wives' self reports of family functioning may be a particularly reliable, sensitive, and valid measurement strategy.

In summary, there is some evidence that

SHI results in impaired social functioning relative to normal controls, however the poor matching of groups raises the possibility that some or all of the differences in social functioning may be due to differences in demographic variables. The evidence for greater impairment of social adjustment in SHI adults relative to other patient or accident groups is inconsistent, and it is not possible at present to attribute with any confidence SHI related impairment in social behaviour or adjustment solely to neurological insult.

We were surprised at the small number of controlled studies that have been published, particularly given the large number of well controlled studies examining cognitive functioning after SHI (see Brooks, 1984b, for a review). Four possible reasons may account for this difference. First, the lack of controlled studies may reflect a lack of sophistication on the part of researchers in this area. Secondly, the large number of uncontrolled studies have presented a remarkable convergence of findings of negative psychosocial outcome (e.g., Bond, 1975; Brooks & McKinlay, 1983; Fahy, Irving, & Millac, 1967; London, 1967; Panting & Merry, 1972; Thomsen, 1984). Researchers may inappropriately consider this to be adequate evidence of impaired social functioning despite the equivocal data from controlled studies. Thirdly, assessing a control group(s) involves at least double the effort on the part of the researcher, and therefore while uncontrolled studies continued to be published there may be insufficient incentive to collect control data. Fourthly, our own experience has suggested that it is extremely difficult to secure the co-operation of matched control subjects (i.e., those of low socio-economic status, limited education and average intelligence), particularly for repeated assessments over time, and subsequently subject attrition may become a problem (e.g., Brooks & Aughton, 1979; Oddy & Humphrey, 1980). Further controlled outcome studies are necessary to determine the effect of SHI on social functioning, and the extent to which these effects are attributable to neurological damage.

Injury Related Factors Predictive of Post-Injury Social Functioning

Severity of Injury

The most commonly measured index of injury severity is duration of post-traumatic amnesia (PTA), defined by Jennett and Teasdale (1981) as the time interval between injury and continuous awareness and memory. Studies that have measured personality change, or correlated PTA with adjective rating scale measures of social behaviour have failed to find significant associations (Bond, 1975; Brooks et al. 1986; Van Zomeren & Van den Berg, 1985).

One study that has provided limited support for a relationship between PTA and social behaviour is Brooks and McKinlay (1983), who found a relationship between PTA and judgements by relatives of whether or not the SHI individual had experienced a personality change. In contrast, relatives' ratings of personality change on adjective rating scales were unrelated to PTA on 17 of 18 scales for this group. Similar negative results have been reported by Levin and Grossman (1977), who failed to find any relationship between duration of coma and scores on the hostile-suspiciousness subscale of the Brief Psychiatric Rating Scale (BPRS) for 70 non-missile wound head-injured patients. These two studies contrast with the consistent finding of a relationship between severity of injury (as measured by duration of coma or PTA) and more global measures of social functioning such as ratings of psychiatric disturbance (Fahy et al., 1967; Levin & Grossman, 1977), or social adjustment as measured by the KAS (Kishavan, Channabsavanna & Reddy, 1981; Weddell et al., 1980). Two studies have examined the relationship between scores on the Neurophysical Scale, a composite measure of impairment on neurological examination, and social adjustment. Bond (1975) found a significant correlation of .48 between neurophysical impairment and a composite measure of social adjustment for a sample of 56 SHI patients, 54 of whom were very severely injured (PTA greater than seven days). Positive findings have also been reported by Weddell et al. (1980) who found a correlation of .88 between neurophysical impairment and personality change at two years post-injury for a group comprising equal numbers of severe (PTA of 1-7 days) and very severe (PTA greater than seven days) SHI adults. It is difficult to know why neurophysical impairment should correlate with personality change when other global measures of injury severity have failed to show such a relationship.

Although personality change has not been found to be consistently associated with injury severity, the quantity (rather than qualitative aspects) of social behaviour is correlated with these measures. Thus, Levin and Grossman (1977) found a correlation between ratings on the Withdrawal-Retardation subscale of the BPRS and duration of coma of .50. In a similar study, Klonoff, Costa, and Snow (1986) examined the relationship between injury severity measures and ratings by relatives of SHI social behaviour on adjective rating scales. The Withdrawal-Retardation subscale had the highest loading on the behavioural outcome factor identified by a canonical correlation analysis as being significantly correlated with injury severity. However ratings on other adjective rating scales that measured personality change (e.g., belligerence, expansiveness), did not load on the behavioural factor for their group of 78 SHI adults, assessed between two and four years post-injury. Finally, Stern, Melamed, Silberg, Rahamani, and Grosswasser, (1985) compared mildly and severely head injured adults (severity being established on the basis of duration of coma and PTA) on a structrued interview measure of Introversion and Extraversion and found significant mean differences on Introversion and Extraversion for the two groups.

In sum, severity of injury, as assessed by duration of coma and PTA, has not been found to be related to personality change following SHI, but has been found to relate to the quantity of social behaviour emitted, with more severely SHI individuals emitting less social behaviour. More global measures of social functioning have been found to relate to severity of injury (as measured by PTA or coma duration), and global social functioning and personality change have each been related to neurophysical impairment in one of two studies.

Localisation of Injury

Levin and Grossman (1977) have provided a model documentation of the biomedical variables commonly assessed at time of injury and related these to patient functioning as assessed by the BPRS. Left and right hemisphere injured patients were contrasted, as were patients with frontal-temporal injuries, with patients with injuries to other parts of the cerebrum. No differences between groups were found on the BPRS. Thomsen (1984) reported that the five patients in her series of extremely severe (PTA more than one month) head-injured adults who displayed disinhibited and aggressive behaviour all had frontal lobe damage. These patients also had PTA's of greater than three months and thus localisation and severity of injury has been confounded in this small group making interpretation ambiguous. Similarly, Klonoff et al., (1986) have confounded injury severity and localisation, by including both Glasgow Coma Score and presence or absence of frontal lobe lesions in a single severity factor. Studies employing adults with brain injuries of a non-traumatic nature have associated altered social behaviour with frontal lobe lesions (Stuss & Benson, 1984). Furthermore, Kolb and Taylor (1981) have found low levels of spontaneous social behaviour to be associated with left frontal lobe lesions, while right frontal lobe excision was associated with increased levels of spontaneous social behaviour. Given these positive findings from studies including non-traumatic SHI adults and the equivocal data from traumatic SHI studies, future studies should attempt to document localisation of injury, in an attempt to clarify the relationship between localisation of injury and post-injury social behaviour.

Pre-Injury Factors Predictive of Post-Injury Social Functioning

Adults who experience a SHI are predominantly male, poor academic achievers, under 30 years of age, and of lower socio-economic status (e.g., Brooks et al., 1986; Hans, Cope, & Hall, 1987; Oddy et al., 1978b). Some authors have suggested that the SHI population may have an atypically high premorbid level of psychopathology (Brooks, 1984a). It is surprising therefore, that few studies have examined the relationship between pre- injury variables (e.g., demographic variables) and post-injury social functioning. Some studies have attempted to assess change in personality from premorbid status (e.g., Brooks & McKinlay, 1983; Oddy & Humphrey, 1980; Oddy et al. 1978b). These studies have not examined the relationship between premorbid social adjustment and post-injury social adjustment, and have relied on retrospective ratings which may be of dubious validity. Only

one study has examined the relationship between demographic variables and social adjustment. Thomsen (1984) correlated age at time of injury with a variety of measures of social adjustment and found no significant relationship. Thomsen's sample represented an extremely severely injured group (most patients had a PTA of three months or greater) and thus a restricted range of scores on the social adjustment variables may have accounted for this negative finding.

In sum, little is known about the relationship between premorbid factors and post-injury social adjustment. Many of the relevant premorbid factors (e.g., age at injury, employment status) can be easily assessed and should be related to post-injury social functioning in future studies.

Post-Injury Factors Associated with Social Functioning

Personality Change

Personality change was strongly related to the burden experienced by relatives in a follow-up of 55 SHI patients reported by Brooks and colleagues. McKinlay and Brooks (1984) found that the emotional state and disturbed behaviour of SHI adults correlated significantly with relative's ratings of subjective burden at three, six, and 12 months after injury. Brooks and McKinlay (1983) found subjective burden related to specific adjective ratings by relatives of personality change at six and 12 months post-injury, and this relationship was still present at five years after injury (Brooks et al., 1986).

Similarly, Weddell et al. (1980) found personality change to be related to relatives' ratings of the dependency of the SHI adult, while Oddy and Humphrey (1980) and Weddell et al. (1980) have found personality change and irritability respectively to be associated with greater impairment of family functioning. The level of burden experienced by relatives appears to increase with time since injury (Brooks et al., 1986; Livingston, Brooks, & Bond, 1985a; 1985b) and has been found to be closely related to the number of subjective complaints made by the SHI individuals (Brooks & McKinlay, 1983; Livingston et al., 1985a). It is tempting to attribute such complaining to changed social behaviour (personality change or neurotic behaviour), however the level of subjective complaints has been found to correlate closely with objective measures of neuropsychological impairment (Dikmen & Reitan, 1977; Novack, Daniel, & Long, 1984) and with objectively assessed post-concussion symptoms (Waddell & Gronwall, 1984).

Only one study examining personality change following SHI has related this to employment outcome. Weddell et al. (1980) grouped their severely and very severely SHI subjects according to whether or not they had experienced a personality change. SHI subjects judged to have had an injury related personality change were significantly less likely to return to work. Similar findings have been reported by Lewinsohn and Graf (1975), who studied a group of 121 mixed neurological disorder patients referred for vocational rehabilitation. Interestingly, a control group of 94 non-SHI adults referred for vocational rehabilitation were found to have similar predictors of employment outcome, which included social behaviour (e.g., social immaturity). This highlights the need to include control samples if predictive factors unique to brain injury are to be identified.

Cognitive Functioning

Level of intellectual functioning as assessed by the Weschler Adult Intelligence Scale (WAIS), was correlated with objective measures of the social behaviour of 11 extremely severely head injured adults by Newton and Johnson (1985). No significant relationship was found with intellectual level. The small sample size and extremely severe injuries sustained (possibly causing a restricted range of scores) may account for this negative finding. No other studies employing SHI adults have specifically examined the relationship between cognitive functioning and social behaviour, although Melamed, Rahamani, Greenstein, Groswasser, and Najenson (1985) examined this relationship in a group of 42 adults with mixed neurological disorders. Performance on eight experimental measures of attentional capacity (dual performance on a pursuit rotor and delayed digit recall task) correlated with ability to follow a multi-participant conversation. Given the positive findings of Melamed et al. (1985) and the important role of cognition in successful social behaviour (McFall, 1982) greater research attention should be focused on this relationship in SHI individuals.

Methodology

The methodology of studies examining social functioning following SHI has typically been poor, with four methodological short comings being particularly common. First, only four of the SHI studies that have been reviewed have made comparisons with a control group. It is not possible to identify changes in social functioning which are uniquely associated with SHI unless an appropriate control group is included (McKinlay & Brooks, 1984).

Secondly, samples have been poorly described both in terms of demographic and injury variables. The reporting of educational and socio-economic status is infrequent (e.g., Newton & Johnson 1985) and many studies have failed to report even mean age (e.g., Rosenbaum & Najenson, 1976). This makes it difficult to compare studies and to determine whether control and patient samples have been adequately matched. Most studies have included a measure of severity of injury, usually duration of coma or PTA, often however the precise method of making these assessments is not provided (e.g., Oddy, Humphrey, & Uttley, 1978b). Standardised measures of duration of coma or PTA should be employed and at a minimum, reliability data reported. For example, assessing PTA, by asking the SHI adult or a relative, as is commonly the pratice (e.g., Brooks & McKinlay, 1983), may be neither reliable nor valid. Similarly, although most studies have described the inclusion criteria for subject selection, this has varied from study to study. Two factors in particular vary between studies: The inclusion of penetrating wound patients in the SHI sample and the source of the SHI sample. Studies have included non-penetrating SHI, both penetrating and non-penetrating, solely penetrating SHI patients, or else this information is not given. This may be important as the neurological effects of penetrating and non-penetrating head injuries are different and may result in a different pattern of psychosocial and behaviour impairment. The SHI subject source has varied from neurosurgery and neurology wards to rehabilitation centres, and may or may not include a consecutive series of admissions. Care must be taken in comparing across studies and future studies should document clearly the nature and severity of the injury along with full inclusion criteria.

Thirdly, the quality of measures of psychological and social functioning have been poor. With the exception of Newton and Johnson (1985), studies have relied solely on questionnaire or structured interview assessments of social functioning. Many of these measures are not standardise reliability data are usually not presented, and assessments are not blind, Although questionnaire and structured interview assessments represent a cost-effective means of data collection, these measures will only ever provide a global assessment of social and psychological functioning. Behavioural assessment methodologies utilizing operationally defined behaviours (rather than global trait labels such as personality change) and direct behavioural observation (e.g., Patterson, 1986) may provide a more accurate, detailed, and valid measure of social behaviour. The application of behavioural assessment methodolgy with SHI adults represents an exciting avenue for future research.

Finally, the majority of the studies reviewed have employed univariate statistics, although the type of statistical test used is not always reported (e.g., Oddy et al., 1978b; Oddy & Humphrey, 1980). This presents two difficulties, the first being that social functioning of SHI adults is likely to have multiple determinants and to be most appropriately assessed using multiple measures. Multivariate statistical techniques may more accurately reflect this complexity. Secondly, multiple univariate comparisons between groups have frequently been employed in studies of SHI. The larger the number of univariate comparisons made, the greater the chance of making a Type 1 statistical error.

General Discussion

A large number of case studies and uncontrolled follow-up studies have identified impaired social adjustment as a common consequence of traumatic SHI. This finding has not been convincingly supported by findings of studies including a control comparison group. Unfortunately such studies have been few in number and methodologically inadequate. Furthermore, it is not possible, given our current empirical knowledge, to attribute any change in social behaviour or adjustment that may occur following traumatic SHI, to neurological damage. This attribution is made even less tenable by the failure to find any significant relationship

between measures of injury severity and social behaviour following injury. It seems likely that more progress will be made in determining whether severe traumatic SHI results in change in social behaviour and social adjustment, and describing qualitatively the nature of change in social behaviour when further controlled outcome studies have been conducted employing behavioural (rather than questionnaire or structured interview) measures of social behaviour completed by blind assessors.

Negative social behaviour by SHI adults has been associated with a number of more global social adjustment measures such as employment and burden experienced by relatives. This is not a particularly surprising finding and may also apply to similar groups (predominantly male, low socio-economic, youthful) who have not sustained a SHI.

As social behaviour following SHI has not been found to correlate significantly with measures of brain injury severity (e.g., duration of coma or PTA), SHI related impairment in social behaviour must be mediated by some other variable(s). One obvious possibility is cognitive impairment (slowed information processing, reduced information processing capacity, or memory impairment) which has ben consistently reported following SHI (Brooks, 1984b). The finding of a relationship between cgnitive ability and social behaviour by Melamed et al. (1985) in a group of mixed neurological disorder patients supports the further study of this relationship as a promising direction for future SHI research. It is possible for example that different paterns of cgnitive impairment are associated with qualitatively different patterns of social behaviour. An alternative explanation of the failure to find a relationship between injury severity and social behaviour is that an impairment in the quantity rather than quality of social behaviour may result from SHI. This possibility is supported by the finding of a significant relationship between injury severity and quantity of social behaviour, and is consistent with the finding of a slowed information processing in SHI adults (Van Zomeren & Deelman, 1978). Future studies should include measures of cognitive ability and precise measures of social behaviour, in order to further examine this relationship, as little is currently known about the relationship between brain functioning and social behaviour. Research employing precisely quantified biomedical data (e.g., Levin & Grossman, 1977), behavioural measures of social functioning (e.g., Newton & Johnson, 1985), and measures of cognitive ability (e.g., Van Zomeren & Deelman, 1978) would seem most likely to document any relationship that might exist and may have implications for the development of therapy programmes for SHI adults.

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