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Autobiographical memory in advanced multiple sclerosis: Assessment of episodic and personal semantic memory across three time spans

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Abstract

In order to investigate the status of remote memory the *Autobiographical Memory Interview* (AMI) was administered to 30 individuals with *advanced* multiple sclerosis (MS). In contrast to earlier studies which have shown only mild deficits in autobiographical memory in those with less physical progression of the disease, about two-thirds (60%) of the present MS sample had a deficit in autobiographical memory. The presence of such a deficit was not related to age, age of onset, duration of illness, or level of physical disability, but was related to level of general cognitive ability. Memory for episodic autobiographical incidents was more affected than for personal semantic information; a temporal gradient typical of some dementing conditions but not before demonstrated in MS, was also observed with memory for more recent events showing a significant decline. (*JINS*, 2002, *8*, 855–860.)

Keywords: Multiple sclerosis, Autobiographical memory, Neurodegenerative disease, Clinical neuropsychology, Cognition

INTRODUCTION

Clinical interest in the assessment of autobiographical memory has grown since the publication of the Autobiographical Memory Interview (AMI; Kopelman et al., 1990) which provided a standardized assessment for the clinical evaluation of individual memory for autobiographical information. This instrument provides an assessment of memory for both episodic autobiographical incidents and personal semantic information across three periods of life: childhood, early adult life, and recent life. Subsequent work has naturally focussed upon the dementias which primarily affect memory, Korsakoff's disease and Alzheimer's disease (Kopelman, 1989, 1994), and on localized cerebral lesions (Kopelman et al., 1999). While the pattern of performance for normal participants is for better recall of more recent autobiographical memories, the results of these studies have shown that neuropsychological conditions affecting memory show a gradient in disruption of retrograde memory affecting recent autobiographical memory while leaving more distant aspects of autobiographical memory relatively unimpaired (Ribot's Law; Ribot, 1882). A more general discussion of the theoretical constructs which underlie autobiographical memory performance may be found in Belli (1998) and Conway and Pleydell-Pearce (2000).

The neuropsychological deficits associated with multiple sclerosis (MS) have only become an active topic of investigation over the past two decades, partly stimulated by the influential review of Rao (1986). It is now clear that there are a variety of aspects of memory which may be affected in MS, as demonstrated by the meta-analysis conducted by Wishart and Sharpe (1997) including remote memory (Beatty et al., 1988, 1989; Rao et al., 1991), but there has been little interest in autobiographical remote memory. The notable exception is the report of Paul et al. (1997) who employed the AMI alongside other measures in examining autobiographical memory in a sample of individuals with MS and a group of matched controls. They observed impairments in autobiographical memory, although these were for personal semantic information, not for the recall of episodic

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autobiographical incidents. Within these impairments the "normal" pattern was preserved, so that recent information was better recalled than early adulthood or childhood information. However, the autobiographical memory impairments were mild, and none of the three periods yielded a mean recall of less than 89% correct in the MS sample; none would be classified as abnormal under the criteria in the *AMI Manual*. It was also the case that the degree of impairment of the MS sample was relatively mild, with a mean of only 3.4 on the Ambulation Index, participants being drawn from a community sample.

The present study investigated autobiographical memory in a sample of individuals with MS who had a greater physical progression of the disease, with the object of establishing whether a temporal gradient in disruption of retrograde memory is exhibited in these individuals; whether more severe impairments of autobiographical memory might be observed than those previously reported in the literature; and whether the dissociation between personal semantic information and memory for episodic autobiographical incidents reported by Paul et al. (1997) is preserved.

METHODS

Research Participants

Participants were 30 residents from the Royal Hospital for Neuro-disability, Putney, London; all had a diagnosis of multiple sclerosis and communication ability sufficient to complete the assessment instruments with assistance. All were severely affected by MS and partially or completely dependent for their care. Participants had an average age of 52.4 years (range 31–66) and an average length of time since diagnosis of 21.4 years (range 3–39). There were no significant differences between the mean age and duration of illness of the 13 men and 17 women who participated.

Measures

Autobiographical memory was examined using the *Autobiographical Memory Interview* (AMI; Kopelman et al., 1990) which provides information on two subscales: The *Autobiographical Incidents Schedule* (AIS) measures recall of incidents from three lifespan periods: childhood (e.g., recall of an incident from the period before the subject went to school), early adult life and recent life, each period is scored out of 9 with a maximum possible score of 27; the *Personal Semantic Schedule* (PSS) measures recall of facts from the same lifespan periods (e.g., recall from recent life: the place where the subject spent last Christmas or Thanksgiving), each period is scored out of 21 with a maximum possible score of 63. Scores of 12 (AIS) and 47 (PSS) or less indicate abnormal memory; abnormality being separately determined for AIS and PSS scores.

Severity of disability was rated using the *Expanded Disability Status Scale* (EDSS; Kurtzke, 1983). This is a 10-point scale; zero (*normal neurological status*) through to 9.5 (*inability to communicate effectively or eat/swallow*) and 10 (*death due to MS*). Duration of illness was defined as the number of years from clinical diagnosis of MS to the evaluation date. The EDSS scores and duration of illness were obtained from the medical records of the hospital in which the participants were resident.

General cognitive ability was assessed by the *Raven's Coloured Progressive Matrices* (CPM; Raven et al., 1995). This individually administered test, which permits multiple choice responding, provides an evaluation of general intellectual ability in those with severe physical and communication difficulties.

Design and Procedure

A three-way mixed factor design was employed to analyze the dependant variable of the AMI recall scores. The repeated measures factors were *lifespan period* (three levels: childhood, early adult, recent life) and *type of autobiographical memory* (two levels: AIS, PSS); the between-subjects factor was *abnormal/normal autobiographical memory*.

The AMI and CPM were individually administered in an interview format so that account could be taken of the communication difficulties of the participants. The CPM was presented in the individually administered form, but where participants were unable to record their responses, they were permitted to either voice the number of the response item selected, point to that item, or otherwise indicate their selection as the examiner polled through the response choices. The multiple choice format of this test therefore allows, in this way, an evaluation of general intellectual ability in those with severe physical and communication difficulties. Care was taken to divide the overall assessment into a number of sessions to counter the effects of fatigue and limited attention and concentration.

RESULTS

Employing the criteria given in the *AMI Manual*, 18 (60%) of the sample were classified as abnormal on the AIS and 19 (63%) on the PSS. All of the 18 who were abnormal on the AIS were also abnormal on the PSS.

Parametric statistics were employed throughout. None of the variables exhibited a significant degree of skewness. While a number of variables departed from statistical normality, this was in all cases the result of restricted range in the data. As "distribution-free" statistics offer no advantage in relation to this problem, and as parametric statistics are more powerful and are generally robust to departures from normality, the use of parametric statistics was considered to be justified (MacRae, 1988; Mitchell, 1986).

There were no significant differences between the normal and abnormal groups on age of onset, duration of illness, or age (Table 1). The groups also did not differ significantly in the degree of disability as assessed by the

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Table 1. Characteristics of the study sample

	Autobiographical Incidents Schedule (AIS)					Personal Semantic Schedule (PSS)				
	Abnormal (n = 18)		Normal (n = 12)			Abnormal (n = 19)		Normal (n = 11)		
Variable	M	(SD)	M	(SD)	p	M	(SD)	M	(SD)	p
Age (years)	52.7	(8.3)	51.9	(12.3)	.832	53.2	(8.4)	51.0	(12.5)	.566
Age at onset (years)	29.1	(8.9)	33.8	(9.9)	.184	30.0	(9.5)	32.7	(9.6)	.455
Duration of illness	23.6	(8.0)	18.1	(10.3)	.109	23.2	(7.9)	18.3	(10.8)	.162
CPM score	11.9	(7.3)	24.0	(8.4)	.001	11.8	(7.1)	25.3	(7.6)	.001
EDSS score	8.5	(0.4)	8.2	(0.5)	.095	8.5	(0.4)	8.2	(0.5)	.072

EDSS. The abnormal groups did, however, have a lower level of general cognitive function as assessed by the CPM [AIS: $t(28) = 4.18$, $p < .001$; PSS: $t(28) = 4.89$, $p < .001$]. Over the whole sample the CPM correlated with total AIS scores ($r = .69$, $N = 30$, $p < .001$) and also with PSS scores ($r = .65$, $N = 30$, $p < .001$).

With respect to AIS scores (see Figure 1), there was a significant effect across the three lifespan periods [$F(2,56) = 3.67$, $p < .05$] and pairwise comparisons revealed that this effect results from a lower score for recent incident recall than for childhood incident recall ($p < .05$). There were, as should be expected, highly significant differences between the abnormal and normal groups [$F(1,28) = 108.43$, $p < .001$]. There was no significant interaction between Lifespan Period × Abnormal/Normal Groups [$F(2,56) = 0.49$].

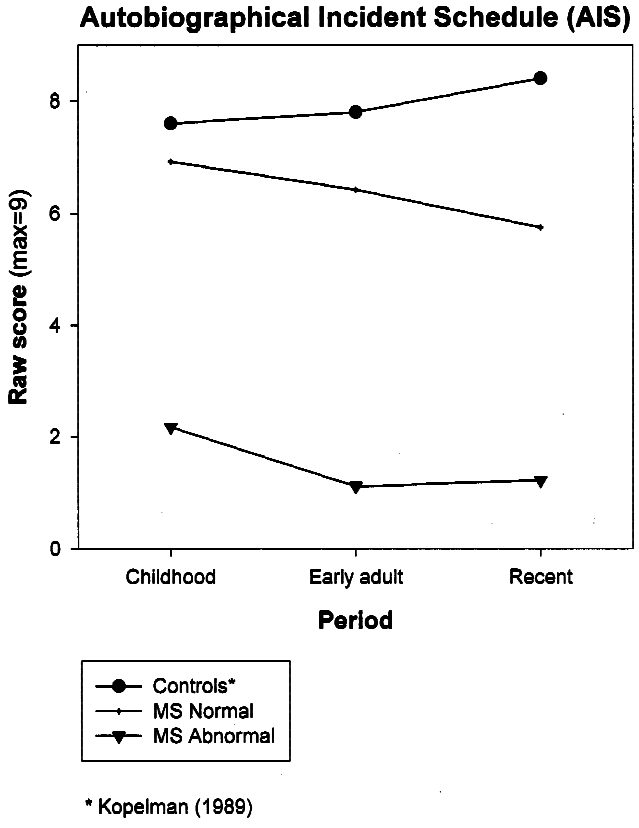

Fig. 1. Pattern of temporal gradients for episodic autobiographical memory.

In analyzing the PSS scores it was clear (see Table 2) that there was greater variance in the recall scores for the abnormal group in comparison to the normals. For this reason the groups were analyzed separately. Within the abnormal group there was a significant effect of lifespan period [$F(2,36) = 6.85$, $p < .01$] with recent semantic information being more poorly recalled than either childhood information ($p < .05$) or early adult life information ($p < .01$; see Figure 2). This effect was not observed for the normal group for whom there was no effect of lifespan period [$F(2,20) = 0.58$]. The abnormal and normal group scores appear to show a clear difference, but the data were not analyzed statistically due to unequal variance.

By excluding the single case that was not concordant on abnormality for the AIS and PSS it was possible to enter the data into a three-way mixed factor analysis that included type of autobiographical recall. Given that the AIS and PSS scales have different maximum scores, the data were converted to percentage recall scores for this purpose. The analysis reveals that the lifespan period effect that is present in the PSS data is also present in the data combining AIS and PSS [$F(2,54) = 5.40$, $p < .05$; comparisons: recent–childhood: $p < .01$: recent–early adult: $p < .05$; Ms: childhood = 59.6, early adult = 56.3, recent life = 49.5]. There was also a main effect of type of recall [$F(1,27) = 64.25$, $p < .001$; Ms: AIS = 43.8, PSS = 66.4], but no significant interaction of Period × Type. As expected, the abnormal and normal groups differed significantly [$F(1,27) = 97.62$, $p < .001$], but there was no higher-order interaction among Lifespan Period × Type of Recall × Abnormal/Normal Groups.

DISCUSSION

It is clear that the present sample of participants with MS had a greater physical progression of the disease than those studied by Paul et al. (1997). While the level of disability in their study was assessed by the Ambulation Index (AI) and in the present study by the EDSS, it is known that these scales correlate highly ($r = .96$; Beatty et al., 1990) and

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Table 2. Recall on measures of autobiographical memory (AMI)

Variable	Abnormal	Normal	Total group
Raw recall scores			
Autobiographical Incident Schedule			
Childhood*	2.2 (2.1)	6.9 (1.4)	4.1 (3.0)[a]
Early adult life*	1.1 (1.4)	6.4 (1.9)	3.2 (3.1)
Recent adult life*	1.2 (1.9)	5.8 (1.8)	3.0 (2.9)[a]
N	18	12	30
Personal Semantic Schedule			
Childhood*	10.3 (4.9)[b]	19.3 (2.1)	13.6 (6.0)
Early adult life*	10.2 (4.8)[c]	19.4 (2.0)	13.5 (6.0)
Recent adult life*	7.1 (5.7)[b,c]	18.6 (1.7)	11.3 (7.3)
N	19	11	30
Percentage recall scores			
Autobiographical Incident Schedule			
Childhood*	24.1 (23.3)	76.8 (16.0)	45.2 (33.3)[a]
Early adult life*	12.3 (15.7)	71.3 (20.9)	35.9 (34.2)
Recent adult life*	13.6 (20.7)	63.9 (19.6)	33.7 (32.0)[a]
N	18	12	30
Personal Semantic Schedule			
Childhood*	48.8 (23.2)[b]	91.7 (9.8)	64.6 (28.4)
Early adult life*	48.4 (22.9)[c]	92.4 (9.6)	64.5 (28.7)
Recent adult life*	33.8 (27.2)[b,c]	88.5 (7.9)	53.9 (34.6)
N	19	11	30

[a,b,c] = significant difference between pairs of means within groups ($p < .05$).
*denotes *M* (*SD*).

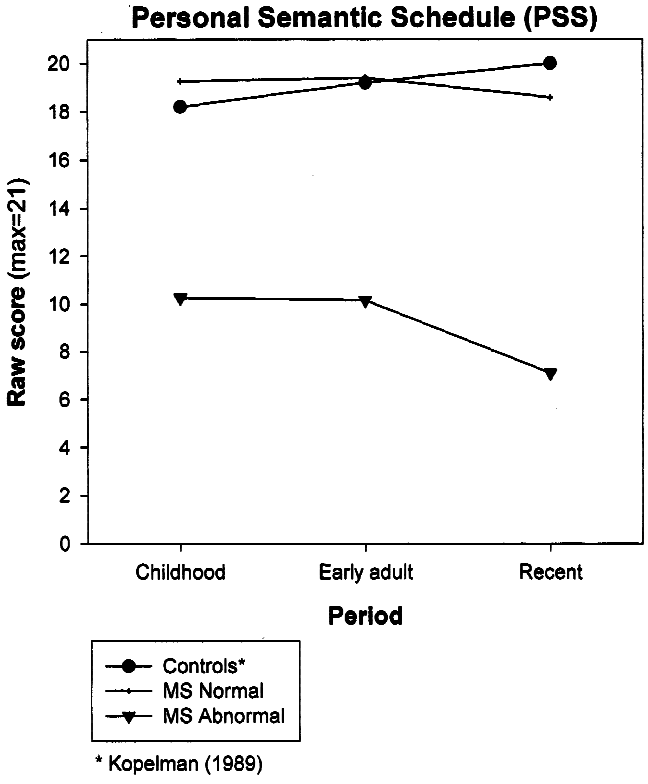

Fig. 2. Pattern of temporal gradients for personal semantic memory.

both employ a 10-point scale. The participants studied by Paul et al. had a mean AI score of 3.4, a mean disease duration of 11.1 ± 5.8 years and were living in the community, while the present sample had a mean EDSS score of 8.4, a mean disease duration of 21.4 ± 9.2 years and were in residential care, and substantially dependent for all aspects of their care.

Given that a sample with advanced MS was studied, it is perhaps not surprising that deficits in autobiographical memory should have been demonstrated, but it has not previously been established that such deficits in memory may accompany more physically progressive forms of MS. About two-thirds of the present sample had a sufficient deficit for them to be classified as abnormal according to the criteria of the AMI.

Given a progressive neurological condition, and especially in the context of the extreme variability of the course of MS, it is important to ensure that any differences between groups are not attributable to the age of those studied, the age of onset of the disorder, or its duration. This is particularly so where periods of previous life are being examined in an autobiographical context and where, for example, an earlier age of onset may have a greater effect upon earlier lifespan periods. The data demonstrate that there are no differences in the present study between those with normal and abnormal autobiographical memory in terms

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of their age, age of onset or duration of illness; none of these variables had a confounding effect upon the results. There was also no significant difference between these groups in the extent of physical disability. In so far as physical disability can be considered an index of the severity of the MS (see Feinstein, 1999, pp. 19–23), then this is not related to the presence of a deficit in autobiographical memory in the present sample. However, the presence of such a memory deficit is related to the level of general cognitive ability as assessed by the CPM; CPM scores correlated highly with the AMI indices and there was a significant difference between the normal and abnormal groups. It is known that the degree of intellectual impairment is poorly related to physical disability in MS as a result of the variable involvement of cortical centres in the disease process (Amato et al., 1995; Beatty, 1993; Feinstein et al., 1993; Hohol et al., 1997; Jennekens-Schinkel et al., 1990). However, where autobiographical deficits are observed, they seem to be an aspect of a wider pattern of intellectual impairment.

The dissociation between AIS and PSS scores observed by Paul et al. (1997) where semantic memory was more affected than episodic memory is, however, not evident in the present data. Deficits among individuals in PSS were hardly more common (19 participants) than deficits in AIS (18 participants), and in so far as percentage recall scores are comparable across AIS and PSS, then AIS percentage recall scores were significantly lower than comparable PSS scores. It would therefore appear that in the present sample, episodic autobiographical incidents (AIS) are less well recalled than is personal semantic information (PSS). It may well be, given the marked difference in the overall level of performance (55% *vs.* 94%), that different pathological processes are in operation in the two samples. It is also the case that the life experiences of individuals living in the community, and those with severe neurological disability in residential care, also differ greatly with consequently different autobiographical experiences. The different dissociations observed in the two studies are also relevant to the debate concerning the dissociability of episodic and semantic aspects of autobiographical memory and the different processes that may support them (Belli, 1998; Hodges & McCarthy, 1993).

Significant deficits in autobiographical memory having been observed in the present study, the temporal gradient of the deficit in MS is naturally of interest. Overall, there is evidence for a gradient that reflects that observed in dementing conditions such as Alzheimer's disease. That is, recent autobiographical information is more severely affected than memories from either childhood or early adult life. The gradient is not as steep as that reported for either Alzheimer's disease or Korsakoff's disease (Kopelman, 1989), probably reflecting the more gradual progression of MS pathology, but a similar effect is to be observed. It is perhaps more surprising that the corollary, that early adult memories are relatively well preserved, is also supported by the present data. However, while personal semantic information is preserved at a near-normal level from earlier periods among those without an autobiographical memory deficit, this is not true of episodic autobiographical incidents, where even among those without formal deficit, the best level of performance is at about 75%. Although the pathological temporal gradient is to be observed across the whole group for both AIS and PSS, the steepest gradient was observed in semantic events for those with a semantic memory deficit, although this effect is exaggerated by comparison with incident recall for those with an incident recall deficit as this problem tends to extend further back into the lifespan than does the semantic deficit.

An awareness of problems of autobiographical memory is important in the care and management of those with severe MS. In severe neurological disability a healthier past existence may gain greater significance when mobility is highly restricted and personal independence has been lost. The impact of autobiographical memory deficits may affect personal interactions and decision-making, and may have important implications for the individual's psychological state and quality of life (Kenealy et al., 2000).

Over a decade ago Rao (1986) concluded on the basis of a comprehensive review of the neuropsychology of MS, that the dementia in MS does not resemble a global, homogeneous decline in cognitive abilities (p. 527); Rao reported "patterns" of deficits on measures of recent memory. The present findings extend these conclusions with evidence of autobiographical remote memory deficits in *advanced* MS, and a temporal gradient in disruption of retrograde memory, not before demonstrated in MS.

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