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Relating the Efficacy of Naltrexone in Treating Self-Injurious Behavior to the Motivation Assessment Scale

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One opiate hypothesis suggests that self-injurious behavior (SIB) is related to elevated sensory thresholds. The present study examined the relationship between scores on the Motivation Assessment Scale (MAS) (Durand and Crimmins, 1988), a 16-item scale designed to determine variables that maintain SIB in developmentally delayed individuals, and response to naltrexone (an opiate blocker). High baseline levels of SIB in 20 subjects were significantly correlated with observations that SIB was maintained by need for attention as measured by the MAS. There were no significant correlations between scores on the MAS and change in SIB to the most effective dose of naltrexone (2.0 mg/kg). The present findings did not support the relationship between response to naltrexone and sensory scores on the MAS.

KEY WORDS: endorphins; mental retardation; Motivation Assessment Scale; naltrexone; opiate blocker; opiates; self-injurious behavior.

INTRODUCTION

There is no universally effective treatment for self-injurious behavior (SIB). However, recent studies have indicated that SIB is reduced by treatment with the opiate blockers naloxone and naltrexone (Herman *et al.*, 1987; Campbell *et al.*, 1989; Sandman 1990/1991; Sandman *et al.*, 1990). Moreover, studies of cerebrospinal fluid (Gillberg and Terenius, 1985) and

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plasma (Sandman *et al.*, 1990) have suggested opioid disregulation in patients exhibiting SIB.

Parallel studies have suggested that functional analysis of behavior has been useful in determining variables which maintain SIB (Repp *et al.*, 1990; Vollmer *et al.*, 1992). As an alternative to formal functional analysis, Durand and Crimmins (1988) designed the Motivation Assessment Scale (MAS), a 16-item scale which addresses four categories of reinforcement (sensory consequences, escape, attention, and tangibles) that may contribute to the maintenance of SIB.

The ability to predict response to naltrexone (NTX) could eliminate or shorten costly drug trials and efficiently match subjects to effective treatments. The present study attempted to relate response to naltrexone with MAS scores in order to discover if such predictions could be made using the MAS. Specifically, a prominent opiate hypothesis (Sandman, 1990/1991) postulates that SIB is the result of elevated sensory threshold and an exaggerated attempt to generate sensory stimulation. The fact that opiate blockers induce hyperalgesia (Grevert and Goldstein, 1977) and reduce SIB (Barrett *et al.*, 1989; Herman *et al.*, 1987; Sandman *et al.*, 1990) is consistent with this possibility. One category of the MAS is designed to detect sensory consequences of SIB and may be used to predict response to NTX.

METHODS

Subjects and Procedures

Twenty-four subjects were enrolled in a 10-week protocol examining the efficacy of naltrexone in patients exhibiting SIB. The design involved two weeks of open placebo and eight weeks of double blind cross-over naltrexone administration. Each subject received three weeks of active naltrexone treatment, with a randomized reversal of three doses (0.5, 1.0, and 2.0 mg/kg); blind placebo was administered during the remaining five weeks.

Throughout the 10 weeks, each subject was videotaped six sessions per day (Monday, Tuesday, and Thursday) for 5 min each session; these sessions were equally divided between mornings and afternoons. Subjects were videotaped in residential, school, and recreational settings. Approximately 90 min of videotape per week was collected for each client, and scored for SIB by blind raters using a computerized observational program described by Hetrick *et al.* (1991). Following the conclusion of the study, research staff who were blind to treatment and responsible for gathering videotaped data over the entire study (and spent approximately 45 hr with

Table I. Subject Characteristics

Highest Category	Description of SIB	Age and Sex	Level of Retardation	Baseline SIB	Treatment % change
Attention	Bite hand	23, M	Moderate	1.6% of hr	-63.22
Tangible	Bang head, pull hair	42, F	Severe	3.25/hr	-64.4
Escape	Slaps head, bite arm, hit body	26, M	Severe	50/hr	57.29
Escape	Bang/hit/slap head, hit arm	41, M	Profound	33/hr	-81.5
Escape	Bang/slap head, slap leg, hit arm	50, F	Profound	33/hr	-98.2
Escape	Slap head/face	26, M	Severe	429/hr	-51
Escape	Hit head	31, M	Severe	797/hr	+105
Sen/Esc	Bang and punch head	36, M	Profound	27.6/hr	-37.9
Sensory	Slap head, bite arm, scratch self	14, F	Severe	4839/hr	-8.3
Sensory	Bang head/back, hit arm	38, F	Profound	27/hr	72.28
Sensory	Bang head	41, M	Profound	14/hr	-29.5
Sensory	Bang head, scratch face/arm	40, F	Profound	28.8/hr	-23.2
Sensory	Bang/hit/slap head, hit arm	37, M	Profound	118.5/hr	-26.1
Sensory	Punch head	33, M	Profound	116/hr	-34.5
Sensory	Bite wrist	32, F	Profound	5.5% of hr	-100
Sensory	Hit leg and arm, pull hair	27, M	Profound	215/hr	-29.3
Sensory	Bang/slap head, poke eye	31, M	Profound	8.2/hr[a]	100
Sensory	Bang/hit/slap head	67, M	Profound	3687/hr	+2.63
Sensory	Hit shoulder	27, M	Severe	43/hr[b]	-100
Sensory	Bite hand/arm	37, M	Profound	6.25% of hr	-12.57

[a]Data from a second pre-treatment baseline week were substituted due to absence of SIB during week immediately preceding first treatment.
[b]Average across multiple baselines.

each client over the 10 weeks) completed the MAS for 20 of these subjects (see Table I for client characteristics).

For subjects with counted behaviors, such as "bangs head" and "slaps arm," SIB was calculated as frequency per hour; for timed behaviors, such as "bites hand" or "pulls hair," SIB was calculated as percentage of time SIB was displayed. Treatment effects were calculated as percent change from baseline (the week preceding treatment) using the following formula:

$$\% \text{ Change} = [(\text{Treatment SIB/Baseline SIB}) - 1] \times 100.$$

The use of "-1" in the formula above allows a reduction in SIB to be shown as a negative figure, and an increase in SIB to be shown as a positive number. It should also be noted that this formula is directionally biased, allowing an infinite range for increase in SIB, while allowing no greater than 100% reduction in SIB.

Motivation Assessment Scale

The MAS is completed by answering questions designed to determine the likelihood of a specific behavior occurring ("never" to "always"). The MAS was completed for each subject by research staff who were also responsible for collecting the videotaped samples, and who had monitored each subject's behavior throughout the study. Scores for questions belonging to each of the four categories (four questions per category) were totaled. The category with the highest mean score is assumed to be responsible for the maintenance of SIB (Durand and Crimmins, 1988). For the purpose of analysis, category means also were ranked from one to four for each subject, with the highest category assigned a rank of one.

RESULTS

Sixty-five percent (n = 13) of the subjects had at least 25% reduction in SIB with the 2.0 mg/kg dose, and seven of these subjects (54%) had at least 50% reduction in SIB. For this reason only the 2 mg/kg was used for testing the opiate hypothesis.

Higher MAS attention rank correlated with higher baseline SIB (r = .693, $p < .01$). However, further analysis revealed that this effect was due to two subjects whose pre-treatment SIB was greater than three standard deviations above the mean. With these subjects removed from the analysis, the effect was not significant (r = .07). There were no significant correlations between scores on the MAS and response to the most effective dose of NTX (2.0 mg/kg).

In a second analysis, subjects were divided into a "high-response" group (n = 7) based on (a) at least a 50% reduction of SIB at the 2.0 mg/kg dose, and (b) a reduction in SIB at the 1.0 mg/kg dose. The remaining subjects were labeled "low/non-responders" (n = 13). Differences on the MAS between these groups were tested with a stepwise discriminant function analysis. There were no differences between the groups on the MAS. Univariate analysis confirmed that the groups did not differ on any of the four scales of the MAS.

DISCUSSION

Reduction in SIB by naltrexone was not significantly related to the sensory consequences category of the MAS. High baseline levels of SIB were significantly correlated with observations that SIB was maintained by

need for attention as measured by the MAS. However, this relationship was not reliable when outliers were removed.

The present findings in 20 subjects treated with naltrexone did not support the hypothesis that response to naltrexone was related to sensory scores on the MAS. This finding suggests that the MAS may not be sensitive to the sensory aspects of SIB proposed by the opiate hypothesis, or that the MAS may not be a reliable or valid instrument for assessment of the variables which maintain SIB (as suggested by Newton and Sturmey, 1991; Zarcone *et al.*, 1991). It is also possible that naltrexone response was only loosely related to the self-stimulation hypothesis; patients may engage in SIB to stimulate a release of endogenous opiate peptides (Sandman, 1990/1991), rather than sensory stimulation alone. These peptides have been shown to be euphorogenic (Belluzzi and Stein, 1977) and may provide internal reinforcement which maintains SIB. The MAS may be insensitive to this type of internal reward seeking.

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