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Effectiveness of an alarm intervention with overlearning for primary nocturnal enuresis

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Abstract *Objective:* To explore the effectiveness of the enuresis alarm with overlearning for treatment of primary nocturnal enuresis (PNE). A key objective was to explore the effect of overlearning on treatment gains, and its impact on relapse.
Patients and methods: The RMIT University Psychology Clinic has been treating PNE in the community for more than 20 years following a standardized treatment protocol. The study analysed archival data of 126 participants, aged ≥5 years, presenting with PNE. A mean wetting frequency of 5.13 wet nights per week was observed at baseline.
Results: Treatment significantly reduced mean wetting from baseline levels during both treatment and overlearning phases, $F(1.41, 176.10) = 588.54$, $p < 0.001$, $r^2 = 0.77$, 95% CI (0.74 −0.81). Wet nights per week reduced from a mean of 5.13 (SD = 1.77) during baseline to 1.88 (SD = 0.85) during treatment, and 0.64 (SD = 0.60) during overlearning. Alarm treatment with overlearning produced a treatment response of 87%, compared with 59% for alarm treatment only.
Conclusions: Evidence of improved treatment response with the addition of overlearning suggests overlearning should be considered as a potentially useful adjunct to alarm treatment for PNE. Overlearning was not unreasonably onerous for participants. Further research is required to explore the impact overlearning has on reducing relapse rates.

Introduction

Monosymptomatic primary nocturnal enuresis (PNE) refers to bedwetting by children, in the absence of lower urinary tract infections, who have never experienced a consistent period of dryness at night that exceeds 6 months [1]. Up to 18.9% of children aged 5–12 years experience some nocturnal enuresis [2], with males overrepresented by a

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ratio of 3:2. PNE is also highly distressing: primary school children have ranked it as the third most stressful life event behind divorce and parental fights [3]. Considering the prevalence and consequences of nocturnal enuresis, effective treatment is imperative [4].

The primary interventions for nocturnal enuresis include the enuresis alarm, desmopressin medication, anti-muscarinic medication, and bladder training [5]. Alarm interventions have been shown to be highly effective to the extent that they are widely endorsed as an optimal first-line treatment for PNE [6,7]. However, a main problem with the treatment is the high relapse rates, with one study showing relapse of 66.7% at 3 months' follow-up [8]. Alarm interventions have also been criticized for being stressful and requiring strong commitment to avoid high dropout rates [9].

In order to address the problem with relapse, overlearning, an adjunct to alarm treatment has been proposed [10,11]. Overlearning refers to a conditioning process which begins with the consumption of additional fluid before sleep. The extra fluid is believed to exert additional stress on the kidneys and in turn the bladder detrusor muscle involved in micturition [11]. If the additional stress is tolerated, then the learnt response is understood to be strengthened; otherwise, urine is passed. Early studies demonstrated that relapse rates were significantly lower using overlearning [12,13]. Unfortunately, apart from these early studies, there remains a paucity of research into overlearning as an adjunct to alarm treatment. If the enuresis alarm with overlearning is to gain greater acceptability, it is imperative to provide further evidence from effectiveness studies applying intention-to-treat analysis.

The current study aims to quantify the effect of overlearning on treatment response and relapse. It is predicted that compared with baseline wetting, wet nights during treatment and overlearning will be significantly reduced; a significant decrease in wet nights will be observed from treatment to overlearning; overlearning will help consolidate treatment gains observed by an improved treatment response, and not constitute an unreasonable burden. Descriptive data will be presented on overlearning, and relapse rates will be compared with those reported in the literature.

Patients and methods

Participants

The current study was conducted at RMIT University Psychology Clinic, Melbourne, Australia, using archival data collected during individual treatment for PNE. The sample was a self-selected convenience sample. Inclusion criteria were PNE diagnosed and participant aged 5–18 years. Exclusion criteria were enuresis medication being used; diurnal or secondary enuresis diagnosed; intellectual disability, or pervasive developmental disorder. Data collected between 1988 and 2009 resulted in 264 potential participants. The final sample comprised 126 participants: 95 males (75.4%) and 31 females (24.6%); participants' mean age = 7.51 years (SD = 1.86) (min. 5.08; max. 13 years).

Procedure

The study was approved by the RMIT University Human Research Ethics Committee. Treatment followed a clinical manual: Bedwetting Program: Guidelines for Clinicians [14]. Assessment comprised clinical interview and recording 14 nights of baseline data. Treatment, using an enuresis alarm from Ramsay Coote Instruments, followed baseline data collection. The bed pad featured a moisture sensor connected to the alarm unit; urine contacting the sensor completes an electric circuit, sounding the alarm. The device was completely safe. The initial treatment goal was 14 consecutive dry nights. Clinicians maintained weekly telephone contact with clients throughout the intervention with careful monitoring of progress. Clients were instructed to commence overlearning, once the initial treatment goal was reached, which involves consumption of 600 mL of additional fluid prior to sleeping. The overlearning criterion is met once 14 further consecutive dry nights were recorded.

Data treatment

Treatment effectiveness was measured according to International Children's Continence Society (ICCS) definitions [1]. Key outcome measures included mean number of wet nights per week [(number of wet nights/number of nights of data) $\times$ 7] and percentage reduction in symptom frequency [(mean wets per week time$_1$ $-$ mean wets per week time$_2$)]/(mean wets per week time$_1$ $\times$ 100).

Results

Intention-to-treat

A total of 126 participants commenced baseline data collection, five of these participants withdrew after baseline data had been collected but before treatment commenced (early dropouts). An intention-to-treat (ITT) group therefore comprised 126 participants included in all analyses, except those analyses where inclusion of early dropouts would have confounded results, such as relapse where the notion does not apply. Data from participants who withdrew once treatment had commenced (n = 121), were included in all analyses.

Wetting frequency

The mean number of wet nights per week decreased at each treatment level as shown in Table 1. A single-factor repeated-measures ANOVA was conducted with three levels of phase (baseline, treatment, overlearning) forming the single factor. Results showed that wetting frequency (mean number of wet nights per week) was significantly affected by the alarm intervention, $F(1.41, 176.10) = 588.54$, $p < 0.001$, $r^2 = 0.77$, 95% CI (0.74–0.81).

Of 121 participants commencing treatment, 105 (86.8%) reached the initial treatment criterion (14 consecutive dry nights), seven participants (5.8%) failed to, four participants (3.3%) withdrew from treatment, and data were