

THE USE OF A PERSONAL DIGITAL ASSISTANT TO ADMINISTER VISUAL ANALOGUE SCALES

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INTRODUCTION

Visual Analogue Scales (VAS) generally consist of 100 mm lines on paper marked with pairs of adjectives e.g. Alert--Drowsy which subjects mark to indicate their feelings. Such scales are easy for subjects to use, but must be manually scored, and this is both tedious and liable to error. A number of attempts have been made to automate VAS. These typically involve either pressing a pair of buttons to move a cursor to the desired position on the analogue line (e.g. MiniDoc), or use a linear slider scale to make the assessment (Clinitrac). These approaches may affect the manner in which a subject approaches the scale, since it is always necessary for there to be a starting position with such devices, unlike a sheet of paper.

Small pen-based electronic devices (Personal Digital Assistants, PDA) offer an alternative approach to automating such data collection. Such devices are simple and natural to use, the pen making a mark on the screen in “electronic ink” in a manner very similar to a normal pen. Thus the

problem of the pre-set starting position is eliminated. Such devices are too small to present 10 cm lines, however, and the question of comparability with the standard paper method arises.

We have investigated the use of a PDA (Apple MessagePad 110) compared to paper in a crossover study of two doses of ethanol compared to placebo. The subjective effects of ethanol are well-known and easy to demonstrate, and thus provide a convenient basis for comparison of different forms of subjective measurement. The study investigated other aspects of ethanol action, which have been reported elsewhere (Cameron et al., 1995).

METHODOLOGY

Eighteen subjects (9 male, 9 female, aged 20-24 years) took part in this three-period crossover study in which they received one of two doses of ethanol or placebo in randomised order. The high dose was 0.8 g/kg up to a maximum of 60g for males and 50 g for females. The low dose was calculated as 70% of the high dose. Subjects completed three forms of the VAS before ethanol and at frequent intervals up to 2¼ h after ethanol.

A set of 10 visual analogue scales was used. Results from the Sober-Drunk VAS are presented here. Scales were presented as (1) 10 cm lines on paper, as generally used; (2) 4 cm lines on paper; (3) 4 cm lines on the PDA screen. The PDA screen is illustrated in Figure 1.

Blood ethanol levels were estimated from breathalyser (Lion Alcoholmeter) readings taken over the study period.

The figure displays two side-by-side screenshots of a Visual Analogue Scales (VAS) interface. Each screenshot contains five horizontal scales, each with two labels at the ends and a vertical tick mark in the middle. The scales are: Alert (left) / Drowsy (right), Dizzy (left) / Steady (right), Bored (left) / Interested (right), Tense (left) / Calm (right), and Well (left) / Ill (right). In the right screenshot, diagonal tick marks are drawn across each scale to indicate a user's current status. At the bottom of each screenshot are two buttons: 'Cancel' on the left and 'OK' on the right.

Figure 1 Screen layouts for the Visual Analogue Scales used in the study. Two pages of scales were presented to subjects, who made a single mark across each line to indicate their current status. Subjects could change their record by making a second mark, whereupon the first mark would disappear.

RESULTS

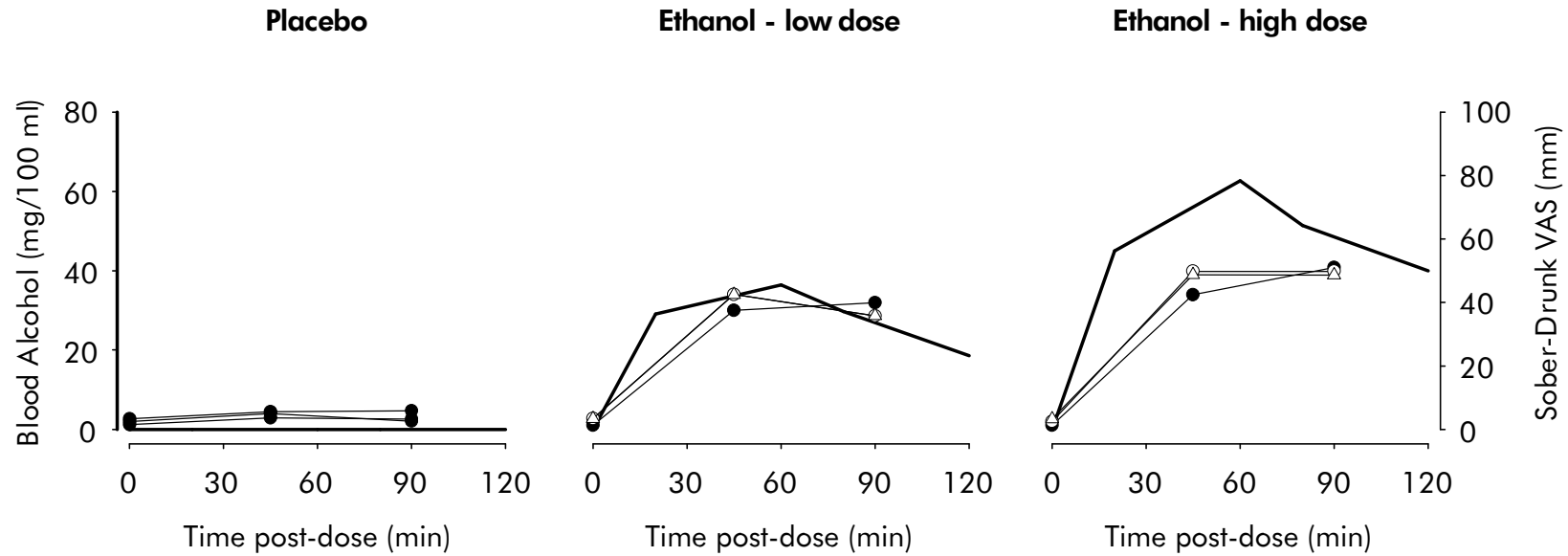


Figure 2. A comparison of results from the sober-drunk VAS with blood alcohol levels. Solid line: Blood Alcohol; Closed circles: Paper, 10 cm VAS; Open circles: Paper, 4 cm VAS; Triangles: MessagePad, 4 cm VAS.

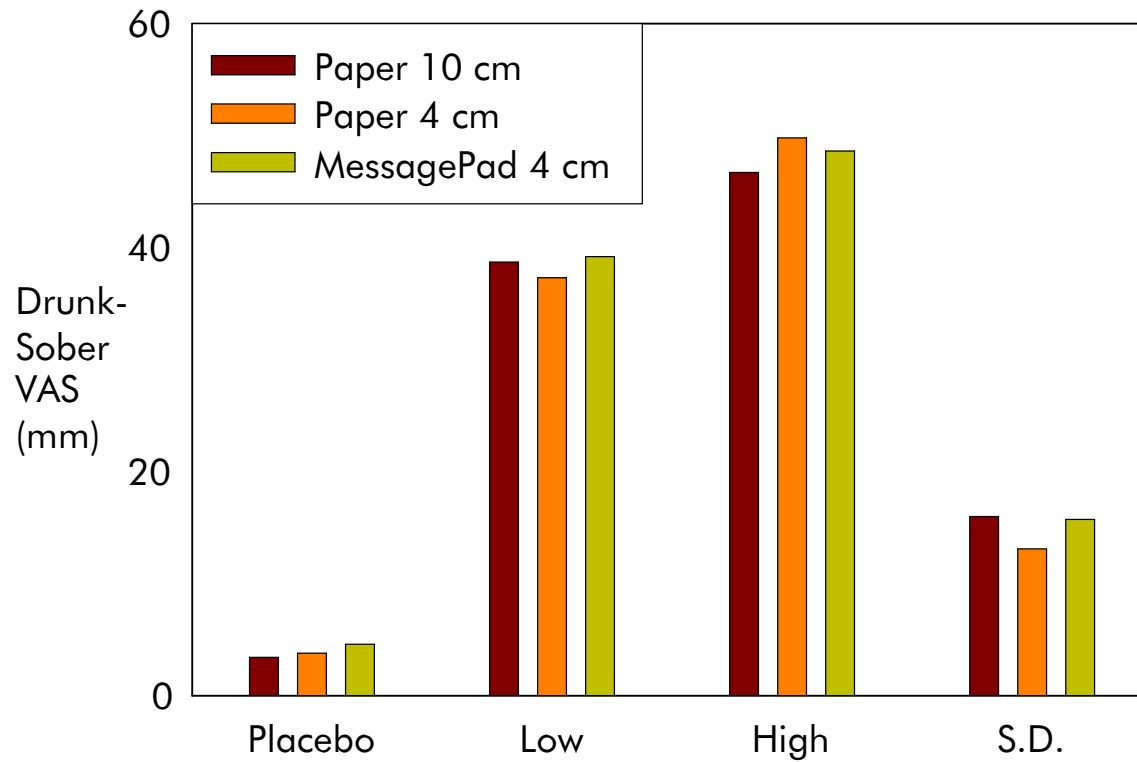


Figure 3. A comparison of the mean scores post-dose for the three types of VAS between placebo, low dose ethanol, and high-dose ethanol (0.8 g/kg) in 18 healthy subjects

DISCUSSION

These data suggest that the use of a PDA for collection of VAS data gives generally similar results to those from paper scales. Not only were the mean scores similar for the different types of scale, but the variability of the measurements was similar, indicating that shorter scale lines can be used without loss of sensitivity, and that the pen-based device provides a practicable alternative to paper and pencil.

These results are supported by a later study (Newman et al., in preparation), in which a similar comparison was made between paper VAS (10 cm) and MessagePad (Figure 4). Again, similar results are obtained for the two scale types.

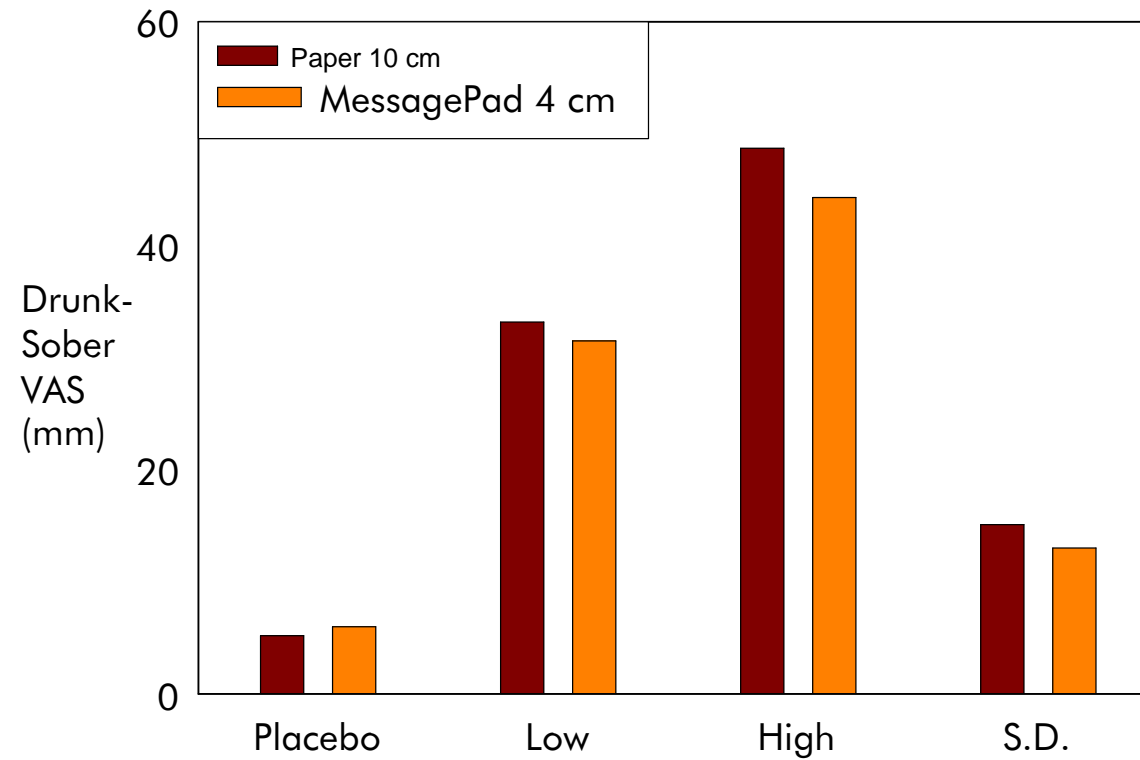


Figure 4 A comparison of the mean scores post-dose for two types of VAS between placebo, low dose ethanol, and high-dose ethanol (0.88 g/kg) in 18 healthy subjects (Data from Newman et al., in preparation).

Subjective ratings such as VAS have often been shown to be more sensitive than objective measures, and the same is true here. The comparison of the lower dose of ethanol with placebo was highly significant ($p < 0.01$), while only one of four objective tests showed significance at this dose. However, the difference between the subjective response to the high dose and that to the low dose is not very great, and subjects seem to be relatively less aware of the higher dose of ethanol (Figure 2). This is of concern in that for many performance measures the impairment follows an accelerating course with increasing dose. Thus subjects may not be sufficiently aware of the extent to which they are impaired as ethanol levels rise towards those known to be associated with substantial increased risk of accidents.

CONCLUSION

Pen-based electronic devices are a convenient and practical way of collecting subjective data in a fashion similar to paper VASs. Results are

similar to those obtained with paper both in terms of the size and the variability of measurements.