

ANXIETY REDUCTION VIA BRIEF INTERVENTION IN DENTALLY  
ANXIOUS PATIENTS: A RANDOMIZED CONTROLLED TRIAL

Hull, P<sup>1</sup>

Humphris, G<sup>2\*</sup>

No. words in abstract: 201

No. words in abstract and text: 5239

No. of Tables: 5

No. of Figures: 1

Key words: dental anxiety, psychological intervention, modified dental anxiety scale,  
randomized controlled trial

1 P Hull, DClinPsychol, Pennine Care NHS Trust, Springleigh, Waterloo Rd,  
Stalybridge, Cheshire, SK15 2AU

2 G M Humphris, PhD, University of St Andrews, Scotland, UK.

\* Corresponding author: Bute Medical School, University of St Andrews, Fife,  
KY16 9TS, Scotland. Tel: +44(0)1334463565, Fax: +44(0)1334463482,  
email: [gerry.humphris@st-andrews.ac.uk](mailto:gerry.humphris@st-andrews.ac.uk)

## ABSTRACT

**Aim:** To compare the degree of anxiety reduction in dentally anxious patients attending a Dental Access Centre where the dentist did or did not receive the patients' assessment of dental anxiety.

**Methods:** Patients attending two Dental Access Centres in England, completed the Modified Dental Anxiety Scale (MDAS). Those that scored high completed a state anxiety questionnaire (STAI-S) and were randomized into three groups (n=182) to test the hypothesis that patients sharing assessment information about their dental anxiety to members of the dental team has beneficial effects on their state anxiety. Group 1 were controls (n=60), Group 2 gave their MDAS to the receptionist who passed it onto the dentist unknown to the patient (n=62) and Group 3 handed their MDAS to the dentist (n=60). After their appointment they repeated the STAI-S.

**Results and conclusion:** Patients in Group 3 were less anxious (by more than STAI-S 3 scale units) on leaving the surgery than those from the other groups especially if they entered into a discussion with the dentist about their concerns (by more than 5 scale units). Brief assessment of dental anxiety shared by the patient with the dentist collaboratively has the potential to reduce anxiety on completion of the appointment.

Dental anxiety is common, has a multifactorial aetiology, and is far from being homogenous, as individuals seem to differ in the origins, age of onset and manifestations of their dental fears (Locker *et al.*, 2001b); (Milgrom *et al.*, 1988). Previous negative experiences are a major factor in the development of dental anxiety (Kleinknect *et al.*, 1973); (Bernstein *et al.*, 1979); (de Jongh *et al.*, 1995); (Locker *et al.*, 1999); (Ost and Hugdahl, 1985). For some individuals, their fear of dentistry may be associated with concurrent anxiety disorders, or more general psychopathology (Locker, 2003); (Locker *et al.*, 2001a).

Dental anxiety has many negative and pervasive effects, and is a significant barrier to the receipt of regular dental care (Walker and Cooper, 2000). Furthermore, there is a strong association between avoidance of dental care and poor oral health. Milgrom *et al.* found that high-fear individuals experience more dental problems such as toothache, difficulty in chewing or bleeding gums within the last twelve months than a comparison low-fear group (Milgrom *et al.*, 1988). Dental anxiety is therefore a contributing factor to oral health problems. Furthermore, a study by Berggren showed that the majority of individuals receiving treatment for severe dental anxiety reported adverse effects on their social life and emotional state (Berggren, 1993).

The factors responsible for continued dental attendance have been explored (Dailey *et al.*, 2001b). In a four-year follow-up study of dentally anxious patients, who had received treatment at a community-based dental fear clinic before being referred to a general dental practitioner, many participants wished their dentist to be aware of their dental anxiety before treatment commenced. An enduring concern was that the dentist would 'forget' or 'overlook' their anxiety. The use of a dental anxiety

questionnaire by the Centre may be one method to indicate to the patient, that their dentist is being vigilant.

Nonetheless, despite the recommended use of questionnaires (Burke and Freeman, 2004); (Newton and Buck, 2000) their use is not widespread in clinical practice (Dailey *et al.*, 2001b). In a study of UK dentists claiming to have a special interest in the treatment of dentally anxious individuals, only one fifth used them routinely. The reason for this low frequency is unclear. Anecdotal evidence from dentists suggests that they believe drawing attention to anxiety-provoking features of the dental setting may be detrimental to the dentist-patient relationship (Dailey *et al.*, 2001b). This may occur by asking patients to focus on specific anxiety-provoking events. Recently, some support for the reactive effect of anxiety measurement has been reported (French and Sutton, 2010). However, it has been confirmed that there are no detrimental effects for patients completing an anxiety questionnaire prior to a dental visit (Humphris *et al.*, 2006). It is also possible that many staff assume that they can reliably identify anxious patients based on clinical impression alone (Dailey *et al.*, 2001b). Unfortunately, there is a far from perfect agreement between patients' self-reports and clinicians' ratings of patients' dental anxiety in validation studies (Humphris *et al.*, 1995).

Another reason for the lack of use of psychometric measures of dental anxiety may be a lack of evidence of their benefits. A randomized control trial has demonstrated significant clinical benefits of such tools to patients, by reducing their state anxiety in the dental setting (Dailey *et al.*, 2002). Participants completed the Modified Dental Anxiety Scale (Humphris *et al.*, 1995) in the waiting room before the dental

consultation, which was then either held at reception, or passed to the dentist by the patient. The patient's state anxiety reduced just prior to leaving the surgery when a combination of two actions occurred concurrently. First the patient handing the MDAS assessment to the dentist and second the dentist being provided with the profile of MDAS ratings for inspection. Patients who left their questionnaires at reception also demonstrated a reduction in state anxiety, but significantly less than the combination of actions above. This approach was a minimal intervention that could become part of routine practice.

Possible explanations for the observed reduction in state anxiety may be formulated. First, the dentist might behave differently after receiving the questionnaire resulting in reduced patient anxiety: for example, being more empathic, enhancing patient control, or modifying their interaction with the patient. Secondly, the expectations of the patient may have been influenced, so they believed the dentist is concerned about their anxiety and performs treatment with extra care. In reality, the dentist may not have actually behaved any differently. Patient expectancy effects have been observed in other areas of research, where they have been found to exert a powerful influence on affect and cognitions (Hull and Bond, 1986); (Vuchinich *et al.*, 1979). Patients may be able to control their anticipatory anxiety regarding dental treatment (Beck *et al.*, 1985); (Meichenbaum, 1985). A more complex study design would be required to explore the possible effects of the dental anxiety questionnaire completion, and method of conveying this information to the dentist, on patient expectancy and dentist behavior (Dailey, 2003).

The aim of the current study was to compare the degree of anxiety reduction in dentally anxious patients attending a Dental Access Centre where the dentist did or did not receive the patients' assessment of dental anxiety.

## METHODS

### **Design of study**

A three group pre-and post-test design was adopted. The original two group methodology was employed, that is a control group (patient completed the MDAS questionnaire and handed it to the receptionist) and the experimental group where the patient handed the MDAS to the dentist. A third group was included. Patients completed the MDAS and handed it to the receptionist whereupon it was given to the dentist. A fourth group, where the patient hands the MDAS to the receptionist and expects it to be handed to dentist when it is not, was considered but on advice was regarded as unethical by the local ethics committee.

Hence the final design (Table 1) was a randomized control trial in which individuals were randomly assigned to one of three independent groups, and pre- and post- dental consultation measures of state anxiety were collected. The dental staff were kept blind to the design of the study. Hypotheses are listed in Table 2.

### **Tables 1 and 2 here**

The design was unable to completely isolate the effects of change in patient expectancy. If a significantly greater reduction in patients' state anxiety was observed in Group 3 in comparison to Group 2, we could ascertain that a change in patient expectancy does contribute to the reduction in state anxiety. However, we would be unable to state that the change in patient expectancy was solely responsible for the

greater reduction, as it could be due to the interaction between a change in patient expectancy *and* a change in dentist behaviour.

A small survey was also conducted to verify that the wording used to notify the participant of the destination of their completed MDAS was correctly understood. Twenty people known personally to the researcher were approached and shown the following statement:

‘...your completed questionnaire will be given to the receptionist and shown to the dentist *before your next visit.*’

They were asked when they would expect the dentist to see the questionnaire, if they had completed it in the waiting room. The wording used ensured that the participants in Group 2 who were led to believe that the dentist would not see their MDAS that day actually consented to him/her seeing at *some point*. All respondents confirmed that they would expect the dentist to see it before they next attended, rather than before the consultation that day. Hence some evidence was obtained prior to the study recruitment that participants clearly believed in a delay to the dentist knowing their level of dental anxiety.

### **Randomisation**

A block randomisation schedule was computer generated by University of Manchester statistician (BT). Pre-sealed opaque envelopes that contained questionnaires specific to each of the three groups were prepared by a colleague. This masking strategy kept

the researcher blind to the group order in an effort to minimise selection bias. All materials were pre-numbered with the participant number to ensure accurate records.

## **Sample**

Dental Access Centres provide general dental services to adults and children who are not registered with a NHS dentist and typically have convenient opening hours, NHS patient charges and receipt of easily available treatment and advice (appointment not always necessary). The study was undertaken at two of these Dental Access Centres in Greater Manchester, and involved patients of three dentists at each practice. These sites were chosen as they both offer treatment to emergency dental patients who were more likely to become dentally anxious than regular attenders (Maggirias and Locker, 2002) . The first Centre was based in an inner city area. The area is ranked 37 out of 354 English districts on the Index of Multiple Deprivation (IMD, where 1 would indicate the most deprived) (Noble *et al.*, 2004) . This Centre offered routine dental appointments and also treated people as ‘drop-in’ emergencies. Centre 2 was based in a satellite town of Greater Manchester, and is ranked 3 on the IMD. This centre served emergency patients only, allocating appointments on a day-to-day basis. Participants were volunteers recruited during their visit to one of the Dental centres and met the following inclusion criteria. Only those that scored 19 and above on the MDAS out of a maximum of 25, or who rated their anxiety as extreme (a score of 5) on any one of the five items, that is the maximum rating category were included (Dailey *et al.*, 2002) . In addition they had to be aged 18 years or above, and read and write English.

Group size was determined by the Dailey *et al.* (2002) study, and therefore provided estimates of the changes in the mean score on the Spielberger State Anxiety Inventory

(STAI-S) (Marteau and Bekker, 1992), between pre- and post-dental consultation in control and intervention groups. A sample size of 180 (60 in each group) was required to detect a difference of 2 in the state anxiety change score between pre- and post-measures, assuming that the common standard deviation was 4 (i.e. effect size = 0.5) when alpha was set at 0.05 with 80% power.

## **Materials**

Each patient approached was given an information sheet explaining the background of the study. They were told that the study was 'to explore the benefits of assessing anxiety in the dental treatment setting'. Randomisation information was denied until after the data collection at that dental visit when a debriefing information sheet was given to all participants on leaving the surgery. The dentists were given information regarding the interpretation of the MDAS questionnaire scores and the dental receptionists/nurses were given instructions regarding the destination of the completed MDAS questionnaires. Dentists were also asked not to instigate a conversation about dental anxiety. A concern was that due to the presence of the researcher, dentists may start to routinely ask about anxiety, which would alert them to the anxiety of Group 1. Dentists were provided with an information sheet and consented. They were informed that an investigation was being made into some patients attending the Access Centre that focused on the assessment of dental anxiety by use of a brief questionnaire. Hence they would receive information about the dental anxiety level of a number of patients. This information would be relayed to them either by the patient themselves or via the receptionist. A debriefing sheet to the dental staff was provided on completion of the study.

## Measures

The MDAS was applied as a screening tool in order to select a sample of dentally anxious participants (Humphris *et al.*, 1995; Humphris *et al.*, 2000). The MDAS is a 5-question self-report instrument, which explores general trait dental anxiety. In addition, it provides further insight into a respondent's anxiety about a particular dental situation or procedure. New norms for the MDAS in the UK have been recently published (Humphris *et al.*, 2009). The six-item short form of the 'State' Scale of the Spielberger State-Trait anxiety Inventory (STAI-S) (Marteau and Bekker, 1992) was used to construct the principal outcome measure. The change in STAI-S scores over the course of the visit, from pre-appointment (baseline) to post-appointment (follow-up) was used. The STAI-S is a self-report measure designed to assess patient state anxiety at the time of completion. It is comprised of six statements depicting how the individual may feel, for example, 'I am calm'. The respondent selects an answer from four response categories ranging from 'not at all' to 'very much'. Scores are summed (with some reverse scoring of individual items) to give a range from six (not at all anxious) to twenty-four (very anxious).

The six-item short form produces scores comparable to those obtained using the full form and has good reliability (Cronbach's alpha equals 0.95). It is sensitive to changes in state anxiety, but is particularly useful in situations when time is limited. Its brevity also reduces the likelihood of obtaining missing values, thus improving validity (Maggirias and Locker, 2002).

**Additional clinical information**

Information concerning the treatment received was obtained from the dental nurses or receptionists following the dental consultation. This information was collected by a checklist on which the dental staff ticked the boxes of the treatment received. The checklist covered all the main forms of dental treatment. The literature suggests that dentally anxious patients find some dental procedures more anxiety-provoking than others, particularly those involving the needle or drill (Humphris *et al.*, 1995). Again, this would ensure that the type of treatment received could be controlled for in the analysis should it not be equivalent between groups.

As well as age and sex, patients were asked if they had attended the Dental Centre previously. The literature suggests that a positive dentist-patient relationship reduces anxiety related to dentistry (Dailey *et al.*, 2001a). An important difference between the current study and that by Dailey *et al.* (Dailey *et al.*, 2002), was that all the participants in the latter study had attended the practice previously. The current study was able to investigate the interaction between the group assignment and previous attendance on state anxiety change. A further concern not identified in the original Dailey *et al.* study was whether the patient discussed their dental anxiety status with the dentist as disclosure of anxious thoughts and feelings is known to reduce state anxiety (Burke and Freeman, 2004; Dailey *et al.*, 2001a).

**Procedure**

Dentists were instructed before the commencement of the study in the interpretation of the MDAS both verbally and in writing. They were told that they would be

receiving a completed MDAS for some patients, either via the dental nurse or the patient themselves.

After registering at the reception, patients were approached consecutively by the researcher in the waiting area, and enquiries were made to establish inclusion eligibility (age and use of English). If these criteria were met, the patient was invited to participate and given a written information sheet. On consent, the participant completed the MDAS and recorded their name on a removable sticker on the MDAS sheet for identification purposes.

Completed MDAS questionnaires were returned to the researcher, scored and patient advised if they were to continue in the study. Those ineligible for inclusion were immediately given a written debriefing information sheet, and their name removed from the MDAS. Those eligible for inclusion were randomly assigned to one of three groups. This was achieved by PH selecting the next opaque envelope which contained a set of questionnaires specific to one of the three groups (as determined by the randomisation schedule).

Participants were asked to complete STAI-S (1) and given a further information sheet detailing the prospective destination of their completed MDAS. Completed questionnaires were then collected by the researcher, who at the same time stated verbally what would happen to the completed MDAS (in the event that anxiety had interfered with their ability to comprehend what would happen from the written details).

At this stage the researcher made a copy of the completed MDAS for the data records. The original copy then followed one of three routes depending on the random allocation to groups:

**Group 1 (Control)**

The MDAS was taken to reception and placed in the bottom of a two-tier tray, to be placed in the patients notes *after* the dental consultation.

**Group 2 ('change in dentist behavior')**

The MDAS was placed in the top tray to be given to the dentist *before* the dental consultation. It was concealed from the patients view in the surgery, and added to the patient's notes after the consultation for future reference.

**Group 3 ('change in dentist behaviour and patient expectancy'):**

The MDAS was given back to the patient to hand it personally to the dentist *before* the dental consultation, on entering the surgery. It was then added to the patient's notes after the consultation for future reference.

The treatment record for each participant was also placed in the bottom tray, for completion by the receptionist or dental nurse after the dental consultation. This had a removable name sticker to ensure that the appropriate information was recorded for each participant. All sheets were numbered to ensure that the materials for each participant were kept together. Every effort was made to keep conditions equal between groups, excepting the destination of the MDAS.

Following the dental consultation, the participant was requested by PH to complete the STAI-S (2), along with several additional questions to elicit clinical and demographic information. Finally, participants were given a written debriefing sheet. The debriefing was specific to each group, including an explanation for the allocation to different groups.

Next, the treatment record was completed by a dental nurse or receptionist, and collected by the researcher. A check was made that the dentist had indeed received the MDAS in groups 2 and 3 by asking the dental nurse and checking in the patient notes. Completed participant materials were placed back in the individual opaque envelopes. Data were collected from October 2003 and April 2004. Ethical approval was given by the Central Manchester Research Ethics Committee (Ref: 03/CM/110). Trial was registered with ClinicalTrials.gov (Ref Number: NCT01190774).

### **Statistical analyses**

SPSS™ for Windows (version 17) was used. Frequency and percentages of participants were calculated in categories for gender, site of recruitment, previous attendance at the Dental Centre, and discussion of their anxiety with the dentist. The mean age was also calculated. Chi-square tests for categorical variables and ANOVA or Kruskal-Wallis tests (where appropriate) for continuous variables were performed to assess group equivalence.

The principle outcome for the study was the change in state anxiety scores (CSTAI-S) from pre- to post-dental consultation, calculated by subtracting the follow-up STAI-S 2 from the pre-dental consultation baseline STAI-S 1. Higher values denoted positive

change, that is a reduction in anxiety. A general linear mixed methods model (GENLIN) using maximum likelihood estimation was performed with groups (0, 1, 2) as a fixed factor, and reported discussion of anxiety (no=0, yes=1) with the dentist, and previous attendance at the Access Centre (no=0, yes=1) as random factors. Age in years was a covariate. All interactions were entered. Planned contrasts between pairs of groups were inspected to test the study hypotheses. Alpha was set to 0.05.

## RESULTS

Over the six-month recruitment period, 994 individuals were approached for potential inclusion in the study, 541 at Centre 1, and 455 at Centre 2. Of these, 40 refused to take part, 44 did not speak and read English, 138 were below the age of eighteen, and 20 had sensory or learning disabilities. In addition, 76 were called into the surgery before screening was complete, and a further 87 individuals were approached who had already taken part in the study on a previous occasion.

A total of 589 individuals consented to trial entry and met the initial inclusion criteria. Participants then completed the STAI-S (1) and the Modified Dental Anxiety Scale (MDAS). Of these, 188 obtained the cut-off score for inclusion on the MDAS and were allocated at random to one of the three groups. Six participants were subsequently excluded owing to procedural error or incomplete questionnaires. No initial baseline STAI values were recorded for these excluded patients. Therefore, complete data were available for 182 participants (Group 1=60, Group 2=62, Group 3=60).

Of the 182 participants within the sample, 114 (63%) were female. The mean (SD) age was 34.4 (13.8) years. 92 (51%) participants were recruited from Centre 1, and 90 (49%) from Centre 2. 76 participants had visited the Dental Centre before, and 106 were attending for the first time. 60 participants discussed their anxiety with the dentist, while 122 did not, according to patient self-report. In terms of treatment received, 102 participants had an examination only or non-invasive treatment, and 80 had invasive treatment. The frequency of patients scoring  $\geq 19$  on the MDAS at the centres was 54% at the inner city centre and 49% at the centre in the satellite town ( $\chi^2$

= 0.54,  $df = 1$ ;  $p = 0.46$ ) comparing with those who scored a 5 for one of the MDAS questions. The patterns of previous attendance at the two centres were no different between the high total scorers and high single item scorers ( $\chi^2 = 0.14$ ,  $df = 1$ ;  $p = 0.71$ ).

Chi-square tests were used to examine the frequency of participants in each category of the categorical variables in the three groups. There was no significant effect of gender ( $\chi^2 = 0.39$ ,  $df = 2$ ,  $p = 0.82$ ) or whether participants discussed their anxiety with the dentist ( $\chi^2 = 1.26$ ,  $df = 2$ ,  $p = 0.53$ ) between the 3 groups. The proportion of participants undergoing invasive treatment (e.g. restoration, extraction) was the same across groups ( $\chi^2 = 0.04$ ,  $df = 2$ ,  $p = 0.98$ , see Table 3).

### **Table 3 here**

A higher proportion of participants in Group 2 had attended the Dental Centre before, in comparison to the other groups ( $\chi^2 = 7.16$ ,  $df = 2$ ,  $p = 0.03$ ). One-way analysis of variance revealed no significant effect by age ( $F(2, 179) = 0.12$ ,  $p = 0.89$ ), or the total MDAS score ( $F(2, 179) = 0.38$ ,  $p = 0.69$ ). Four dentists were recruited, two in each Centre.

The main aim of the current study was to compare the state anxiety reduction in the three groups, to test the primary hypotheses. Complete data for baseline and follow up assessments were obtained satisfying an intention to treat analysis. The mixed methods linear model described above was fitted following Levene's test of homogeneity of variance confirming the dependent variable scores from each group

showed a similar variance ( $F(11,170) = 1.01, p = 0.44$ ). Shapiro Wilks tests for distributional normality by group were unremarkable (all  $p$ 's  $> 0.2$ ).

There were significant effects of group ( $Wald \chi^2(2) = 6.84, p = 0.033$ ) and discussion of anxiety ( $Wald \chi^2(1) = 5.09, p = 0.024$ ). There was no effect of previous Access Centre attendance ( $Wald \chi^2(1) = 0.16, p = 0.69$ ). Therefore the change in state anxiety in the whole sample was generally unaffected by whether or not the patient had previously visited the Dental Access Centre. There was a significant interaction between group and previous Access Centre attendance ( $Wald \chi^2(2) = 7.07, p = 0.029$ ). There was an interaction between group and discussion of anxiety ( $Wald \chi^2(2) = 6.66, p = 0.036$ ). The 3 way interaction effect (group, previous Access Centre attendance and discussion of anxiety) was not significant ( $Wald \chi^2(2) = 2.37, p = 0.31$ ).

**Table 4 here**

Examination of the estimated marginal means and confidence intervals in each of the three groups indicated that the change in state anxiety score was significantly reduced in Group 3 compared with Groups 1 and 2 (Table 4).

**Table 5 here**

The interaction between group and whether or not the participant discussed their anxiety with the dentist was statistically significant. Examination of the estimated marginal means and confidence intervals in Table 5 indicated that those in Group 3 who discussed their anxiety with the dentist showed a significantly greater reduction in state anxiety than participants in the same group who did not discuss their anxiety, and those in Groups 1 and 2, regardless of whether or not they discussed their anxiety. It is also clear from the results of this analysis that participants in Groups 1 and 2 who

discussed their anxiety with the dentist did not show any greater reduction in state anxiety than those who did not discuss their anxiety. Therefore the concern that spontaneously discussing dental anxiety may have confounded the experimental manipulation was not justified. A separate *post-priori* analysis of Group 3 patients showed that those who entered into a discussion with the dentist about their anxiety had a significant reduction in mean anxiety (10.05, 95% CIs: 6.90 to 13.21) compared with those who did not instigate a discussion (4.22, 95% CIs: 2.56 to 5.90); ( $F(1,55) = 8.00, p = .007$ ).

## DISCUSSION

The delivery of a completed dental anxiety questionnaire by the patient to their dentist appeared to confer a beneficial effect on state anxiety on leaving the surgery. This supported the first hypothesis (H1). The other two hypotheses (H2 and H3) were not confirmed. The statement addressing hypothesis 1 requires qualification. The group effect interacted with both previous Access Centre attendance and also with a discussion, or not, with the dentist about dental anxiety status. Hence, this study has shown that patients completing the MDAS reduced their state anxiety when both the dentist received it and the patient expected this, but only when a discussion of dental anxiety ensued. In addition, the effect of patients informing their dentist about their dental anxiety through the MDAS appears to be positive when the patient has attended the Centre previously. A feature of the previous study by Dailey *et al.* was that all participants had attended their dental practitioner at least once before. Therefore, the reduction reported by Dailey *et al.* (2002) may have been enhanced due to this positive familiarity. We may have observed a greater reduction in Group 3 had all these patients attended that particular Centre before.

Furthermore, Dailey *et al.* did not explore the effects of discussion of anxiety with the dentist, and it may be that this was a crucial factor in the reported efficacy of the MDAS (Dailey *et al.*, 2002). Those who discussed their anxiety with the dentist generally improved more than those who avoided broaching this subject. However, the degree of improvement was only significantly greater in Group 3. Close to a 6 unit reduction in state anxiety discovered in this group of patients who had discussed their anxiety with their dentist would, if reproducible, indicate a clinically significant improvement (Wardle *et al.*, 1999). Therefore encouraging patients and dentists to

enter into a discussion of anxiety is obviously beneficial, but independently this is not enough to effect a significant reduction in state anxiety. Discussion is particularly effective when it is conducted alongside the handing of the MDAS questionnaire from patient to dentist. It appears to be a combination of changes in patient expectancy, possibly a change in dentist behaviour and discussion of anxiety that leads to a greater reduction of state anxiety. There was no difference between groups in the frequency of participants who discussed their anxiety; therefore it is likely that handing the MDAS to the dentist does not in itself facilitate a discussion of anxiety, although it may facilitate a qualitatively different discussion of anxiety. A focus on the interaction between patient and dentist, and especially its content, warrants further research.

Perhaps in Group 3 the passing of the MDAS from patient to dentist encourages a more detailed discussion of anxiety in relation to the items on the MDAS. In this group the act of the patient giving the MDAS to the dentist, may have led to both parties to feel more comfortable about raising the issue of dental anxiety. Dentists were asked to follow the patients' lead on discussing anxiety. It was felt that the presence of the researcher may encourage the dentist to ask all patients about their anxiety, which would alert him/her to the existence of anxiety in Group 1.

The previous attendance at the Dental Access Centre may have enhanced the effect of the patient giving the MDAS to the dentist. The literature suggests that a positive dentist-patient relationship is an important factor in reducing patient anxiety (Sondell *et al.*, 2004); (Yamalick, 2005). Specifically, the identification and acknowledgement of patient distress increases patient alliance (Shields *et al.*, 2005). Studies conducted

in the medical setting show clearly the benefit of responding to concerns and cues raised by patients in clinical communication especially by reducing anxiety (Butow *et al.*, 2002).

Information was not collected to identify which patients were revisiting the dentist that they had previously seen. Such a detailed investigation is warranted as the scope to manipulate the information from the MDAS to the dentist is limited by justifiable ethical concerns.

The limitations of this study require some attention. First, the design of the study was weakened by ethical considerations so that the planned 4 group experiment had to be restricted to 3 groups. Notwithstanding this change the study enabled some important hypotheses to be tested. Secondly, the introduction of variables to control for possible bias (namely: discussion of anxiety and previous Dental Centre attendance) increased complexity of the tested model. These two additional factors however, provided extra assistance to our understanding of patient response to their visit. The additional pairwise comparisons between the subgroups should be treated with caution as they were introduced as supplementary *post-priori* investigations. To isolate the effect of supplying dental anxiety assessment information or simply any health-related assessment a further 'control' group could have been included in the design. That is a measure of general health such as an oral health-related quality of life instrument could have been an alternative questionnaire to the MDAS handed to the dentist.

There are two crucial questions that merit further enquiry. First, what dentist-patient communication occurs when the MDAS is delivered to the dentist by the patient? A

detailed study of the content of the exchange between these parties may assist with our understanding of how a patient's state anxiety can be alleviated by the end of the treatment session (Kvale *et al.*, 2004b); (Sondell *et al.*, 1998); (Sondell *et al.*, 2004). Furthermore the clinical significance of the expression of patients' concerns (Zimmermann *et al.*, 2007) and how this is responded to by the health provider has become a fascinating new field of interest with new instruments to assist in this process (Del Piccolo *et al.*). Increasingly, there is recognition of the importance of communication skills utilised by dentists (Yamalik, 2005). Secondly, we are not clear what effect, if any, the reduction in state anxiety, may have on the patient's subsequent visiting behaviour and anxiety level.

In conclusion, the patient completing the MDAS and delivering it to the dentist may be an effective minimal intervention especially if the patient is encouraged to raise the issue of dental anxiety with the dentist. Behavioral interventions tend to be effective (Kvale *et al.*, 2004a). Previous work adopting such interventions typically rely on a programme of input from specially trained staff and may involve substantial resource and repeated visits (Eli *et al.*, 2004). The adoption of the MDAS completion is warranted already for routine assessment purposes but may also be recommended to deliver potential benefits to the patient. Further detailed study will strengthen our understanding of the dynamics of the dentist-patient relationship and how the experience of receiving dental care can be improved.

#### ACKNOWLEDGEMENTS

The assistance of dental staff and patients that participated in the study is gratefully acknowledged. Thanks go to Barbara Tomenson for preparing the randomisation schedule. This work was fully supported by the Division of Clinical Psychology,

University of Manchester, UK.

## REFERENCES

- Beck A, Emery G, Greenberg R (1985). *Anxiety disorders and phobias: A cognitive perspective* New York: Basic Books.
- Berggren U (1993). Psychosocial effects associated with dental fear in adult dental patients with avoidance behaviours. . *Psychological Health* 8(185-196).
- Bernstein D, Kleinknecht R, Alexander L (1979). Antecedents of dental fear. *Journal of Public Health Dentistry* 39(2):113-124.
- Burke F, Freeman R (2004). *Preparing for Dental Practice* Oxford: Oxford University Press.
- Butow PN, Brown RF, Cogar S, Tattersall MH, Dunn SM (2002). Oncologists' reactions to cancer patients' verbal cues. *Psychooncology* 11(1):47-58.
- Dailey Y, Crawford A, Humphris G, Lennon M (2001a). Factors affecting dental attendance following treatment for dental anxiety in primary dental care. . *Primary Dental Care* 8(2):51-56.
- Dailey Y, Humphris G, Lennon M (2001b). The use of dental anxiety questionnaires: a survey of a group of UK dental practitioners. *British Dental Journal* 190(8):450-453.
- Dailey Y, Humphris G, Lennon M (2002). Reducing patients' state anxiety in general dental practice: a randomized controlled trial. *Journal of Dental Research* 81(5):319-322.
- Dailey Y (2003). *Dental anxiety: Identification in primary care (PhD)*. Liverpool, University of Liverpool.
- de Jongh A, Muris P, ter Horst G, Duyx M (1995). Acquisition and maintenance of dental anxiety: The role of conditioning experiences and cognitive factors. *Behaviour Research and Therapy* 33(2):205-210.
- Del Piccolo L, de Haes H, Heaven C, Jansen J, Verheul W, Bensing J, Bergvik S, Deveugele M, Eide H, Fletcher I, Goss C, Humphris G, Kim YM, Langewitz W, Mazzi MA, Mjaaland T, Moretti F, Nubling M, Rimondini M, Salmon P, Sibbern T, Skre I, van Dulmen S, Wissow L, Young B, Zandbelt L, Zimmermann C, Finset A (2010). Development of the Verona coding definitions of emotional sequences to code health providers' responses (VR-CoDES-P) to patient cues and concerns. *Patient Educ Couns* ePUB(25).
- Eli I, Baht R, Blacher S (2004). Prediction of success and failure of behavior modification as treatment for dental anxiety. *European Journal of Oral Science* 112(4):311-315.

- French D, Sutton S (2010). *British Journal of Health Psychology*.
- Hull J, Bond C (1986). Social and behavioural consequences of alcohol consumption and expectancy: A meta-analysis. . *Psychological Bulletin* 99(3):347-360.
- Humphris G, Morrison T, Lindsay SJE (1995). The Modified Dental Anxiety Scale: UK norms and evidence for validity. *Community Dental Health* 12(143-150).
- Humphris G, Freeman R, Campbell J, Tuutti H, D'Souza V (2000). Further evidence for the reliability and validity of the Modified Dental Anxiety Scale. *International Dental Journal* 50(6):376-370.
- Humphris G, Clarke H, Freeman R (2006). Does completing a dental anxiety questionnaire increase anxiety? A randomised controlled trial with adults in general dental practice. *British Dental Journal* 201(1):33-35.
- Humphris G, Dyer T, Robinson P (2009). The modified dental anxiety scale: UK general public population norms in 2008 with further psychometrics and effects of age *BMC Oral Health* 9(20).
- Kleinknecht RA, Klepac RK, Alexander LD (1973). Origin and characteristics of fear of dentistry. *Journal of the American Dental Association* 86(842-848).
- Kvale G, Berggren U, Milgrom P (2004a). Dental fear in adults: a meta-analysis of behavioural interventions. *Community Dental Oral Epidemiology* 32(4):250-64.
- Kvale G, Milgrom P, Getz T, Weinstein P, Johnsen T (2004b). Beliefs about professional ethics, dentist-patient communication, control and trust among fearful dental patients: the factor structure of the revised Dental Beliefs Survey. *Acta Odontologica Scandinavica* 62(1):21-29.
- Locker D, Liddell A, Dempster L, Shapiro D (1999). Age of onset of dental anxiety. *Journal of Dental Research* 78(3):790-796.
- Locker D, Thomson W, Poulton R (2001a). Psychological disorder, conditioning experiences, and the onset of dental anxiety in early adulthood. *Journal of Dental Research* 80(6):1588-92.
- Locker D, Thorn B, Poulton R (2001b). Onset of and patterns of change in dental anxiety in adolescence and early adulthood: a birth cohort study. *Community Dental Health* 18(2):99-104.
- Locker D (2003). Psychosocial consequences of dental fear and anxiety. *Community Dentistry and Oral Epidemiology* 31(144-151).
- Maggirias J, Locker D (2002). Five-year incidence of dental anxiety in an adult population. *Community Dental Health* 19(3):173-9.

- Marteau TM, Bekker H (1992). The Development of a Six-Item Short-Form of the State of Scale of the Spielberger State-Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology* 31(301-306).
- Meichenbaum D (1985). Stress inoculation training New York: Pergamon Press.
- Milgrom P, Fiset L, Melnick S, Weinstein P (1988). The prevalence and practice management consequences of dental fear in a major US city. *Journal of the American Dental Association* 116(641-647).
- Newton J, Buck D (2000). Anxiety and pain measures in dentistry: a guide to their quality and application. *Journal of the American Dental Association* 131(10):1449-1457.
- Noble M, Wright G, Dibben C, Smith G, McLennan D, Anttila C, Barnes H, Mokhtar C, Noble S, Avenell D, Gardner J, Covizzi I, Lloyd M (2004). The English Indices of Deprivation 2004 (revised). London: Office of the Deputy Prime Minister: Neighbourhood Renewal Unit.
- Ost L-G, Hugdahl K (1985). Acquisition of blood and dental phobia and anxiety response patterns in clinical patients. *Behaviour Research and Therapy* 23(1):27-34.
- Shields C, Epstein R, Franks P, Fiscella K, Duberstein P, McDaniel S, Meldrum S (2005). Emotion language in primary care encounters: reliability and validity of an emotion word count coding system. *Patient Education and Counseling* 57(232-238).
- Sondell K, Soderfeldt B, Palmqvist S (1998). A method for communication analysis in prosthodontics. *Acta Odontologica Scandinavica* 56(1):48-56.
- Sondell K, Soderfeldt B, Palmqvist S (2004). Underlying dimensions of verbal communication between dentists and patients in prosthetic dentistry. *Patient Education and Counselling* 50(2):157-65.
- Vuchinich R, Tucker J, Sobell M (1979). Alcohol, expectancy, cognitive labelling and mirth. *Journal of Abnormal Psychology* 88(6):641-651.
- Walker A, Cooper I (2000). Adult dental health survey 1998: United Kingdom. . London: HMSO.
- Wardle J, Taylor T, Sutton S, Atkin W (1999). Does publicity about cancer screening raise fear of cancer? Randomised trial of the psychological effect of information about cancer screening. *British Medical Journal* 319(1037-1038).
- Yamalik N (2005). Dentist-patient relationship and quality care 3. Communication. *International Dental Journal* 55(4):254-256.
- Zimmermann C, Del Piccolo L, Finset A (2007). Cues and concerns by patients in medical consultations: a literature review. *Psychological Bulletin* 133(3):438-63.



Table 1 Description of Groups

Group	Dentist receives MDAS assessment prior to treatment	Patient aware that dentist informed of their MDAS score	Comment
1 Control	No	No	
2 Behaviour	Yes (from receptionist)	No	Dentist 'behaviour' may reduce anxiety
3 Behaviour + Expectancy	Yes (from patient)	Yes	Both dentist 'behaviour' and patient expectancy may reduce anxiety

Table 2 Hypotheses

Hypotheses	Comment
<p>H1. When the <i>dentist receives the completed MDAS</i> questionnaire before treatment, and the <i>patient expects this</i> (Group 3), the patients' state anxiety on leaving the surgery will be reduced significantly more than when it is left at reception (Group 1).</p>	<p>Replication of original Dailey <i>et al.</i> (2002) study</p>
<p>H2. When the <i>dentist receives the MDAS</i> before treatment, but the <i>patient does not expect this</i> (Group 2), the patients' state anxiety on leaving the surgery will be reduced significantly more compared with when the MDAS is left at reception (Group 1).</p>	<p>A change in dentist behaviour alone may effect a reduction in patients' state anxiety.</p>
<p>H3. When the <i>dentist receives the MDAS</i> and the <i>patient expects this</i> (Group 3), the patients' state anxiety on leaving the surgery will be reduced significantly more than when the <i>dentist receives the MDAS</i> but the <i>patient does not expect this</i> (Group 2).</p>	<p>A change in patient expectancy may contribute to a reduction in patients' state anxiety.</p>

Table 3 Comparison of groups to test for equivalence

<b>Variable</b>	<b>Group 1 (n=60)</b>	<b>Group 2 (n=62)</b>	<b>Group 3 (n=60)</b>	<b>df</b>	<b><math>\chi^2</math></b>	<b><i>p</i></b>
<b>Frequencies (%)</b>						
<b>Gender (male)</b>	21 (35%)	25 (40%)	22 (37%)	2	0.39	0.82
<b>Previously attended (yes)</b>	23 (38%)	34 (55%)	19 (32%)	2	7.16	0.03*
<b>Discussion of Anxiety (yes)</b>	19 (32%)	18 (29%)	23 (38%)	2	1.26	0.53
<b>Invasive treatment (yes)</b>	27 (45%)	27 (44%)	26 (43%)	2	0.04	0.98
	<b>Mean (SD)</b>			<b>df</b>	<b><i>F</i></b>	<b><i>p</i></b>
<b>Age</b>	33.7	33.8	35.6	2,179	0.33	0.72
<b>Dental Anxiety (MDAS)</b>	18.2 (3.7)	18.8 (3.5)	18.6 (3.7)	2,179	0.38	0.69

\*  $p \leq .05$

Table 4 Summary results of analysis of variance with change of state anxiety as dependent variable

Group	Mean	SE	95% Confidence Interval	
			Lower	Upper
1 Control	4.02 <sup>a</sup>	0.79	2.47	5.57
2 Behaviour	5.01 <sup>ab</sup>	0.76	3.51	6.51
3 Behaviour + Expectancy	7.14 <sup>b</sup>	0.91	5.36	8.92

Different superscript denotes significant contrast ( $p < .01$ )

Table 5 Means, standard errors and 95% CIs of state anxiety change across experimental groups and response to anxiety discussion question

Group	Did you discuss your anxiety with the dentist?	Mean	SE	95% Confidence Interval	
				Lower	Upper
1 Control	Yes	4.02 <sup>a</sup>	1.37	1.35	6.70
	No	4.01 <sup>a</sup>	0.82	2.41	5.61
2 Behaviour	Yes	5.30 <sup>a</sup>	1.29	2.76	7.84
	No	4.71 <sup>a</sup>	0.81	3.12	6.30
3 Behaviour + Expectancy	Yes	10.05 <sup>b</sup>	1.61	6.89	13.21
	No	4.25 <sup>a</sup>	0.85	2.56	5.89

Different superscript denotes significant contrast ( $p < .05$ )

Figure Legend

Figure 1 Trial Profile

Figure 1

