Community Dent Oral Epidemiol 2001; 29: 456–63
Printed in Denmark . All rights reserved

COMMUNITY DENTISTRY AND ORAL EPIDEMIOLOGY
ISSN 0301-5661

Psychological disorders and dental anxiety in a young adult population

D. Locker[1], R. Poulton[2] and W. M. Thomson[3]

[1]Faculty of Dentistry, University of Toronto, Toronto, Ontario, Canada; [2]Dunedin Multidisciplinary Health and Development Research Unit, Department of Social and Preventive Medicine, School of Medicine, and [3]Department of Oral Health, School of Dentistry, University of Otago, The University of Otago, Dunedin, New Zealand

Locker D, Poulton R, Thomson WM. Psychological disorders and dental anxiety in a young adult population. Community Dent Oral Epidemiol 2001; 29: 456–63.

Abstract – *Objectives*: It has been suggested that some individuals who are fearful or anxious about dental treatment have a constitutional vulnerability to anxiety disorders as evidenced by the presence of multiple fears, generalized anxiety or panic disorders. This paper compares the prevalence of psychological disorders among dentally anxious and non-anxious groups drawn from the general population. *Methods*: Data were obtained as part of a birth cohort study when study members were aged 18 years. They were assessed using the Dental Anxiety Scale (DAS) and the Diagnostic Interview Schedule (DIS). The disorders diagnosed by the DIS were major depressive episode, dysthymia, generalized anxiety disorder, panic disorder, agoraphobia, social phobia, simple phobia, obsessive compulsive disorder, conduct disorder, cannabis and alcohol dependence. *Results*: Overall, 12.5% of study members had DAS scores of 13 or more and were considered to be dentally anxious. Those who were dentally anxious were more likely than the non-anxious to be diagnosed with one or more psychological disorders (55.0% vs. 42.3%). However, those with DAS scores of 13 or 14 (moderately dentally anxious) were broadly similar to the non-anxious in terms of their psychological profile. This excess prevalence of psychological disorder was largely accounted for by high rates of disorder among those with DAS scores of 15 or more (highly dentally anxious). The highly anxious were more likely than the non-anxious to have a diagnosis of conduct disorder, agoraphobia, social phobia, simple phobia or alcohol dependence. Odds ratios ranged from 2.8 to 5.0 after controlling for the effects of gender. The data also suggested that dentally anxious individuals with psychological disorders were more likely to maintain their anxiety over time. *Conclusions*: In this population of young adults, high rates of psychological disorder were characteristic of those with high levels of dental anxiety. Psychological disorder was related to the maintenance of dental anxiety over time.

Key words: dental anxiety; psychological disorder; phobia; young adults

D. Locker, Community Dental Health Services Research Unit, Faculty of Dentistry, University of Toronto, 124 Edward Street, Toronto, Ontario M5G 1G6, Canada
Tel: +1 416 979 4907
Fax: +1 416 979 4936
e-mail: david.locker@utoronto.ca

Submitted 18 July 2000;
accepted 14 February 2001

Epidemiological studies suggest that between 3% and 20% of the population have levels of fear and anxiety about dental treatment that can be considered to be problematic (1, 2). The wide variation in rates is partly accounted for by the fact that some studies measure dental fear and some measure dental anxiety, which may be different, though related, constructs. Although it is generally believed that dental fear and anxiety develop in childhood, there is some evidence to suggest that one-third to one-half suffer onset in adolescence or adulthood (2, 3). Recent evidence has also suggested that the etiology of dental anxiety may vary according to age of onset (4).

Based on the work of Milgrom et al. (5) and Weiner & Sheehan (6), dentally anxious individuals are now considered to fall into one of two broad groups with respect to the origins of their fears and anxieties about dental treatment. Weiner & Sheehan (6) termed these groups exogenous and endogenous. In

the first, an aversion to dental treatment is believed to be a conditioned response that develops as a result of direct or vicarious traumatic experiences. In the second, it is considered to be a component of a constitutional vulnerability to anxiety disorders as evidenced by multiple fears, generalized anxiety or panic disorders. Locker et al. (4) have also suggested that multiple fears or generalized anxiety states may be related to the maintenance of dental anxiety, so that those in the endogenous group will be less likely than those in the exogenous group to remit over time.

While many studies have examined the role of conditioning experiences in the development of dental fear and anxiety, data concerning the prevalence of psychological disorder in dentally fearful and anxious subjects are limited. A number of studies have compared the psychological characteristics of individuals who are and are not dentally anxious and demonstrated that the former are characterized by multiple other fears, such as a fear of pain and blood and body injury fears, agoraphobic symptoms, high trait anxiety and anxiety sensitivity (7–9). However, these studies used instruments such as the Fear Survey Schedule II (10), the Spielberger Trait Anxiety Index (11), the Mutilation Questionnaire (12) and the Symptom Checklist-90 (13), which are psychological scales rather than diagnostic instruments. Consequently, they do not provide information on the proportion of these individuals whose psychological problems are sufficiently severe to warrant a formal diagnosis.

To date, only one study has assessed the association between psychopathology and dental phobia using psychiatric assessments and American Psychiatric Association DSM-III-R (14) diagnostic criteria. Roy-Byrne et al. (15) studied 73 individuals attending for treatment at a dental fear research clinic, most of whom were women. Forty-four (60%) of the 73 patients met the criteria for simple phobia only. The remainder had anxiety (20%), mood (16%), substance abuse (4%) and eating disorders (2%). Of the 15 patients with anxiety disorders, eight had panic disorder, four generalized anxiety disorder (GAD) and four social phobia. Only four subjects had multiple disorders.

Because the study by Byrne et al. (15) was of a self-referred clinical population whose mean score on the Dental Fear Survey (16) was twice as high as that of regular dental patients, the results cannot be generalized to all individuals with dental fear and anxiety. Moreover, the study did not include a non-anxious control group against whom the prevalence of psychological disorder could be compared. Consequently, this paper uses data from a birth cohort study to compare the prevalence of psychological disorder among dentally and non-dentally anxious groups drawn from the general population. Study participants were aged 18 years old when the data on which the paper is based were collected. Since the study is longitudinal, it also examines the role played by psychological disorder in the maintenance of dental anxiety over time. The hypotheses tested were: i) that the prevalence of psychological disorder is higher in dentally anxious than non-anxious subjects and ii) that dentally anxious subjects with accompanying psychological disorder, particularly anxiety disorders, will be more likely to maintain their anxiety over time.

Methods and results

Study procedures

The data reported in this paper were obtained from the Dunedin Multidisciplinary Health and Development Study (DMHDS). This is a longitudinal study of a birth cohort of children who were born at the Queen Mary Hospital, Dunedin, New Zealand, between 1 April 1972 and 31 March 1973 and whose mothers lived within the Dunedin Metropolitan Health District boundaries (17). Of the children known to be alive at age 3 and living in the Dunedin Metropolitan Area (n=1139), 1037 entered the longitudinal phase of the study. There were no differences between those who entered the study and those who did not on a number of perinatal and neonatal measures assessed at birth. However, compared to the rest of the New Zealand population born at the same time, the DMHDS sample was slightly advantaged in terms of socio-economic status (17).

A diverse range of psychological, medical and sociological measures was used to assess the health and development of study members every 2 years between the ages of 3 and 15, and again at 18, 21 and 26 years. A dental examination was conducted at ages 5, 9, 13, 15, 18 and 26 years. At the dental examination conducted at ages 15, 18 and 26 years, a questionnaire was administered and used to collect information on dental anxiety and dental visiting patterns. Further details of the data collected at each assessment can be obtained from Silva & Stanton (17).

This paper uses data from the assessment undertaken at the age of 18 years. This was the first of

the adult phases of the study during which data on dental anxiety and psychological disorders were collected.

Measures

Dental anxiety

The four-item Corah Dental Anxiety Scale (DAS) (18) was used to measure dental anxiety at 18 and 26 years. The scores of the response codes for these four items added together ranged from 4 to 20. Dentally anxious individuals were defined as those with a DAS score of 13 or more (19). When analyzing the data collected at the 18-year phase, the sample was divided into three groups. Those with a DAS score of 12 or less were classified as ''not anxious'', those with a score of 13 or 14 were classified as ''moderately anxious'' and those with a DAS score of 15 or above were classified as ''highly anxious''.

Dental visiting pattern

Based on their responses to questions concerning dental visits, study members were categorized as ''avoiders'', ''symptomatic visitors'' and ''preventive visitors''.

Psychological disorder

At age 18 years, psychological health in the previous 12 months was measured using a modified form of the Diagnostic Interview Schedule (DIS) (20, 21). The DIS was developed by the U.S. National Institute of Mental Health and consists of a highly structured interview schedule that allows lay interviewers or clinicians to make psychiatric diagnoses based upon DSM-III-R criteria for disorder. It was developed specifically for use in epidemiological studies of population mental health. The disorders diagnosed by the schedule and utilized in this paper were: major depressive episode, dysthymia, generalized anxiety disorder, panic disorder, agoraphobia, social phobia, simple phobia, obsessive compulsive disorder, conduct disorder, cannabis dependence and alcohol dependence.

For each disorder, study participants were asked a series of questions pertaining to the presence of symptoms characteristic of that disorder. Those reporting symptoms were then asked an additional set of questions concerning their behavioural and other consequences. Diagnoses of disorder were based on the presence of symptoms, impairment in daily functioning as a result of those symptoms, help seeking and/or police contact using computerized algorithms developed by a team of psychologists and psychiatrists (22). Consequently, for each disorder, symptom scores and DSM-III-R diagnoses were obtained, allowing for dimensional and categorical approaches to the measurement of psychological health (23).

Data analysis

The analysis was limited to study members for whom complete data were available. Following the computation of univariate statistics, study members falling into the three categories based on their DAS scores were compared for differences in DIS diagnoses. The statistical significance of differences between groups was tested using chi-square tests. Odds ratios were used to examine the strength of the associations between dental anxiety and individual diagnostic categories. DIS diagnoses were examined individually and after grouping into three broad classes; namely, anxiety disorders, mood disorders and behavioural disorders. DAS data at age 26 were used to identify dentally anxious subjects who had remained dentally anxious and those who had remitted. Chi-square tests and *t*-tests were used to determine if DAS scores at age 18 or DIS diagnoses at 18 predicted outcome at age 26.

Results

Response

At the assessment at 18 years, 993 (97%) of the living cohort of 1027 individuals participated. The Diagnostic Interview Schedule (DIS) was completed by 930 study members, and data on dental anxiety were obtained from 805. There were no differences in terms of gender, dental visiting pattern, DIS symptom scores or DIS diagnoses between the subjects from whom data on dental anxiety were and were not collected. Nor were there any differences in terms of gender for those on whom complete data were or were not collected. Of the former, 48.9% were female and 51.1% male.

Prevalence of dental anxiety at age 18 years

The mean DAS score of the 805 study members for whom dental anxiety data were available was 8.5 (SD=3.0). Overall, 12.5% (n=100) had DAS scores of 13 or more and were considered to be dentally anxious. Of these, approximately two-thirds (n=64) were classified as moderately anxious and one-third (n=36) as severely anxious. Consequently, the

distribution of study members in terms of dental anxiety was as follows: not anxious, 87.5%; moderately anxious, 8.0%; and highly anxious, 4.5%. Women had significantly higher DAS scores than men (8.9 vs. 8.2; $P<0.001$: *t*-test). Of those with DAS scores above 13, women were more likely than men to be classified as highly anxious (43.1% vs. 26.2%). However, this difference just failed to reach statistical significance ($P=0.06$).

Of the 100 study members classified as dentally anxious, only eight met DSM-III-R criteria for dental phobia. These individuals represent only 1% of the sample overall.

Prevalence of psychological disorder

Overall, 43.9% of the sample on whom complete data were collected were diagnosed with one or more psychological disorders and 20.4% had two or more diagnoses. The most common diagnoses were major depressive episode (16.8%), alcohol dependence (16.4%) and social phobia (13.3%) (Table 1). There were no differences between females and males in the proportions with one or more diagnoses or the proportions with two or more diagnoses. However, females were more likely to have a diagnosis of major depressive episode ($P<0.001$), agoraphobia ($P<0.05$), social phobia (($P<0.01$) and simple phobia ($P<0.01$), while males were more likely to be diagnosed with conduct disorder ($P<0.001$), cannabis dependence ($P<0.01$) or alcohol dependence ($P<0.001$).

Psychological disorder and dental anxiety

Study members with a DAS score of 13 or more were more likely than those with scores of 12 or below to have one or more psychological disorders (55.0% vs. 42.3%; $P<0.05$: chi-square test). However, the excess prevalence of disorder among those with scores of 13 or more was largely accounted for by those classified as highly anxious. Almost three-quarters (72.7%) of those with high levels of dental anxiety (DAS scores of 15 and above) had one or more DSM-III-R diagnoses compared with 45.3% of the moderately anxious (DAS scores of 13 or 14) and 42.3% of those who were not dentally anxious (DAS score of 12 or less). Highly anxious study members were also more likely than the other two groups to have multiple diagnoses (Table 2). The mean number of disorders in each of the three groups was as follows: not anxious, 0.8 (SD=1.2); moderately anxious, 1.0 (SD=1.6); and highly anxious, 1.6 (SD=1.4) ($P<0.001$: One-way analysis of variance).

The three groups used in the analysis were different with respect to four of the individual diagnoses; conduct disorder, agoraphobia, social phobia and simple phobia. Differences with respect to alcohol dependence just failed to reach statistical significance ($P=0.06$). With respect to simple phobias, significant differences between the three groups emerged for injection phobia only, with 1.7%, 1.6% and 8.3% respectively diagnosed with this disorder ($P<0.05$; chi-square test). The groups did not differ in the prevalence of phobias concerning blood, heights, storms, enclosed spaces, being in water, animals or insects.

When moderately anxious study members were compared with those who were not anxious, only one difference was observed. The former were more likely than the latter to have a diagnosis of

Table 1. Percent with psychological disorders: all study members and males and females

Percent with:	All subjects ($n=805$)	Males ($n=413$)	Females ($n=392$)	P*
One or more disorders	43.9	40.7	47.2	NS
Two or more disorders	20.4	19.4	21.4	NS
Major depressive episode	16.8	10.5	23.3	<0.001
Dysthymia	3.0	2.2	3.8	NS
Panic disorder	1.0	0.5	1.5	NS
Conduct disorder	8.0	12.5	3.3	<0.001
Generalized anxiety disorder	1.9	1.0	2.8	NS
Agoraphobia	4.9	3.2	6.6	<0.05
Social phobia	13.3	10.0	16.6	<0.01
Simple phobia	7.3	4.7	10.0	<0.01
Obsessive compulsive disorder	4.1	2.9	5.4	NS
Cannabis dependence	6.3	8.6	3.8	<0.01
Alcohol dependence	16.4	20.8	11.8	<0.001

* *P*-values for differences in proportions between males and females: chi-square test.

Table 2. Percent with psychological disorder by dental anxiety status

Percent with:	Not anxious (n=705)	Moderately anxious (n=64)	Severely anxious (n=36)	P*
One or more disorders	42.3	45.3	72.7	<0.01
Two or more disorders	18.6	25.0	47.2	<0.001
Major depressive episode	15.9	23.8	22.2	NS
Dysthymia	2.7	4.8	5.6	NS
Panic disorder	1.0	1.6	0.0	NS
Conduct disorder	6.9	14.3	19.4	<0.01
Generalized anxiety disorder	1.7	3.2	2.8	NS
Agoraphobia	4.4	4.8	13.9	<0.05
Social phobia	12.1	15.9	30.6	<0.01
Simple phobia	6.4	9.5	19.4	<0.01
Obsessive compulsive disorder	4.0	3.2	8.3	NS
Cannabis dependence	6.3	7.8	2.8	NS
Alcohol dependence	15.9	14.3	30.6	P=0.06

* P-values for differences in proportions between groups: chi-square test.

Table 3. Percent with one or more anxiety, mood or behavioural disorders by dental anxiety status

Percent with:	Not anxious (n=705)	Moderately anxious (n=64)	Severely anxious (n=36)	P*
One or more anxiety disorders	21.6	27.0	52.8	<0.001
One or more mood disorders	16.9	25.4	25.0	NS
One or more behavioural disorders	20.3	22.2	36.1	NS
One or more anxiety *or* one or more mood disorders	30.3	39.7	58.3	<0.001
One or more anxiety *and* one or more mood disorders	7.9	12.7	19.4	<0.05

* P-values for differences in proportions between groups: chi-square test.

conduct disorder (14.3% vs. 6.9%; P<0.05). However, the highly anxious were more likely than those who were not anxious to have a diagnosis of conduct disorder, agoraphobia, social phobia, simple phobia or alcohol dependence (P<0.05 in all comparisons). Logistic regression analyses indicated that all associations remained significant after controlling for the potentially confounding effects of gender. Odd ratios derived from these analyses indicated that moderately anxious study members were 2.5 times at risk of having a diagnosis of conduct disorder compared to non-anxious study members. When highly anxious and non-anxious study members were compared, the odds ratios were as follows: conduct disorder, 5.0; agoraphobia, 3.0; social phobia, 2.9; simple phobia, 3.0; alcohol dependence, 2.8.

Further analyses were undertaken by collapsing the diagnoses into three broad groups: anxiety disorders (panic disorder, generalized anxiety disorder, agoraphobia, social phobia, simple phobia, obsessive-compulsive disorder); mood disorders (major depressive episode, dysthymia) and behavioural disorders (conduct disorder, cannabis dependence, alcohol dependence). Highly dentally anxious study members had a significantly higher prevalence of anxiety disorders than the moderately anxious and not anxious. Differences in the prevalence of mood and behavioural disorders were not significant (Table 3). Among the highly dentally anxious, 58.3% had anxiety *or* mood disorders, with 19.4% having a combination of anxiety *and* mood disorders.

Endogenous and exogenous dental anxiety

Using these diagnostic data, the proportion of dentally anxious study members who fall into the endogenous category can be estimated. However, the estimate varies considerably according to how ''constitutional vulnerability'', the key characteristic of the endogenous type, is defined. If those with one or more anxiety disorders *or* one or more mood

Table 4. Percent of study members dentally anxious at age 18 remaining dentally anxious at age 26 by presence of psychological disorder at age 18 years (n=100)

		% dentally anxious at age 26	P*	RR
One or more psychological disorders at age 18 years:	No	40.9%		1.5
	Yes	61.8%	<0.05	(1.0–5.1)
One or more anxiety disorders at age 18 years:	No	50.0%		1.2
	Yes	58.3%	0.426	(0.8–1.9)
One or more mood disorders at age 18 years:	No	47.9%		1.6
	Yes	68.0%	0.083	(0.9–3.0)
One or more behavioural disorders at age 18 years:	No	49.3%		1.4
	Yes	63.0%	0.226	(0.8–1.9)

* P-values for differences between groups with and without psychological disorder.
RR: Relative risk and 95% confidence interval.

disorders are considered to be of the endogenous type, then the proportion is 46.5%. If the more stringent definition of one or more anxiety disorders *and* one or more mood disorders is used, then the proportion falls to 15.2%. However, most of the study members with anxiety and/or mood disorders were not dentally anxious. For example, 82.2% of those with anxiety *or* mood disorders were not anxious about dental care and 78.6% of those with anxiety *and* mood disorders had DAS scores of 12 or less.

Psychological disorder and the maintenance of dental anxiety

Of the 100 study members who were dentally anxious at age 18 years, only 53 were dentally anxious at age 26. DAS scores at age 18 years did not predict outcome at 26 years. The mean score at 18 for those remaining dentally anxious was 14.6 (SD=1.6) compared with 14.1 (SD=1.4) for those whose anxiety remitted. There were no sex differences in the proportion remaining anxious – 55.2% of women and 48.8% of men had DAS scores of 13 or over at age 26. However, study members with one or more psychological disorders at age 18 were more likely to be dentally anxious at age 26 than study members with no diagnoses at age 18 (61.8% vs. 40.9%: P<0.05; chi-square test).

Since the numbers of individuals with some of the individual DIS diagnoses were small, it was not possible to undertake meaningful statistical analysis to determine which of these diagnoses predicted outcome at age 26. Consequently, the ability of the three broad classes of diagnoses to predict outcome was examined. Although the prevalence of all three types of disorder at age 18 was higher in those remaining dentally anxious than in those remitting, with relative risks ranging from 1.2 to 1.6, the differences did not reach statistical significance (Table 4).

Discussion

In this sample of young adults, the prevalence of dental anxiety was 12.5%, which falls within the range reported by other investigators. Although approximately one-third of those who were dentally anxious had DAS scores of 15 or more, less than 10% met DSM-III-R criteria for phobia. Consequently, the results reported here apply to individuals who are anxious rather than highly fearful about receiving dental care.

Just over two-fifths of the sample had one or more psychological disorders based on DSM-III-R criteria and just over one-fifth had two or more diagnoses. While these rates appear to be high, they approximate those found in epidemiological studies of general populations. For example, the National Comorbidity Survey (NCS), a study of a probability sample of the US non-institutionalized population aged between 15 and 54 years, found that the lifetime prevalence of anxiety disorders was 24.9% and the 12-month prevalence was 17.2% (24). This compares well with a prevalence of 22.0% (95% confidence interval=19 – 24%) for the young adults who make up the sample for the DMHDS. Prevalence rates for agoraphobia, social phobia and simple phobia derived from the NCS and DMHDS were also similar (23). In addition, the Epidemiological Catchment Area Study (ECAS), a large psychiatric epidemiological survey undertaken in the US in the 1980's, reported that the prevalence of any phobia was 18.5% (25). In the DMHDS the prevalence of any phobia was 21.0%. Data from the

NCS and ECAS also suggest that comorbidity is common with many individuals with anxiety disorders also having mood and substance abuse disorders (26).

Data from the DMHDS confirmed the first hypothesis addressed by this paper. As anticipated, the prevalence of psychological disorder was higher among dentally anxious study members than among the non-anxious. However, those with moderate levels of dental anxiety, as indicated by DAS scores of 13 and 14, were broadly similar to the non-anxious in terms of their psychopathological profile. There were no differences between these two groups in the overall prevalence of disorder or in the prevalence of multiple disorders. They differed with respect to only one of the 11 diagnoses examined – conduct disorder.

Study members with DAS scores of 15 or more were distinct in that almost three-quarters had one or more disorders. Consequently, this highly dentally anxious group accounted for much of the excess prevalence of psychological disorder among those who were dentally anxious. The finding that this category had the highest rates of agoraphobia, social phobia and simple phobia confirms work by previous investigators who have suggested that agoraphobic symptoms and social fears are integral components of dental anxiety (8, 27). This indicates that these individuals are more likely to belong in the endogenous group identified by Weiner & Sheehan (6) and to manifest a constitutional vulnerability to anxiety disorders. This highly anxious group did not show significantly higher rates of panic or generalized anxiety disorder than other study members, but the prevalence of these conditions in the sample as a whole was very low. Subjects with DAS scores of 13 or 14 did not differ from the non-anxious in terms of the prevalence of anxiety disorders and may therefore belong to the exogenous category as defined by Weiner & Sheehan (6).

The highly dentally anxious category also showed high rates of conduct disorder and alcohol dependence. It is probable that these conditions are linked to the anxiety disorders to which these individuals are subject rather than to dental anxiety per se. A number of studies have shown, for example, that alcohol abuse is a common complication of social phobias and other anxiety disorders (26). However, it should be noted that the moderately dentally anxious were more likely than the non-anxious to be diagnosed with conduct disorder even though they did not differ with respect to the diagnosis of anxiety disorders.

When the diagnoses were grouped into three broad categories, a slightly different pattern emerged. Highly dentally anxious study members had a significantly higher prevalence of anxiety disorders but not mood or behavioural disorders. They were more likely to have one or more anxiety *or* one or mood disorders and one or more anxiety *and* one or more mood disorders. Overall, only 45% of dentally anxious study members had one or more anxiety *or* one or more mood disorders and only 15% had one or more anxiety *and* one or more mood disorders. Clearly, other factors such as conditioning experiences have a role to play in the acquisition of dental anxiety. Moreover, since only a minority of study members with diagnoses of anxiety or mood disorders were dentally anxious, these other factors might play a more important role than psychopathology.

The second hypothesis addressed by the study was also confirmed. Dentally anxious study members with one or more psychological disorders at 18 were more likely to be dentally anxious at the assessment at 26 years than those without. However, contrary to expectations, anxiety disorders at age 18 did not predict outcomes at age 26. Those who remained anxious had higher rates of mood and behavioural disorders at age 18, but the differences did not reach statistical significance. Given the relatively small numbers involved in these analyses, the results should be treated with some caution.

This is the first study to use a comprehensive psychological assessment to compare the prevalence of psychological disorder in dentally anxious and non-anxious individuals drawn from the general population. The one limitation of the study is that all those participating were aged 18 years when assessed. Consequently, while the results may be generalized to other young adult populations, they may not hold for children, older adults or the elderly. Further studies are necessary to determine if the associations between dental anxiety and psychological disorder observed here apply to these other age groups and if the relationship between psychological disorder and the maintenance of dental anxiety over time also applies at other points in the life span.

The study is also limited in terms of casting light on the etiological assumptions contained within Weiner & Sheehan's (6) classification of dental anxiety. At age 18, dental anxiety and psychological disorder were measured concurrently. Consequently, it is not possible to determine whether anxiety

and/or mood disorders play a causal role by making an individual more vulnerable to direct or indirect conditioning experiences. Longitudinal studies are needed to clarify this etiological question. That psychological disorders appear to be related to the maintenance of dental anxiety does not necessarily mean that they are implicated in its onset. However, that most of those with anxiety and mood disorders were not anxious about dental care suggests that dental anxiety is a distinct state and not an integral component of these disorders even among those who may be considered to fall into the endogenous category.

Acknowledgements

The Dunedin Multidisciplinary Health and Development Research Unit is supported by the Health Research Council of New Zealand. Data collection was partially supported by US Public Health Service Grant MH-45070 from the National Institute of Mental Health. The authors are indebted to Dr P. A. Silva and Dr R. H. Brown for their contribution to the study and to the study members for their continued support and participation.

References

1. Eli I. Oral psychophysiology: stress, pain and behaviour in dental care. Boca Raton: CRC Press; 1992.
2. Milgrom P, Fiset L, Melnick S, Weinstein P. The prevalence and practice consequences of dental fear in a major US city. J Am Dent Assoc 1988;116:641–7.
3. Ost L. Age of onset of different phobias. J Abnorm Psychol 1987;96:223–9.
4. Locker D, Liddell A, Dempster L, Shapiro D. Age of onset of dental anxiety. J Dent Res 1999;78:790–6.
5. Milgrom P, Weinstein P, Kleinknecht R, Getz T. Treating fearful dental patients. Reston, Virginia: Reston Publishing Co.; 1985.
6. Weiner A, Sheehan D. Etiology of dental anxiety: psychological trauma or CNS chemical imbalance? Gen Dent 1990;22:39–43.
7. Fiset L, Milgrom P, Weinstein P, Melnick S. Common fears and their relationship to dental fear and utilization of the dentist. Anaes Prog 1989;36:258–64.
8. McNeil D, Berryman L. Components of dental fear in adults. Behav Res Ther 1989;27:233–6.
9. Locker D, Liddell A, Shapiro D. Diagnostic categories of dental anxiety. Behav Res Ther 1999;37:25–37.
10. Geer R. Development of a scale to measure fear. Behav Res Ther 1966;3:45–53.
11. Spielberger C, Gorusch R, Luchene R. Manual for the state-trait anxiety inventory. Revised edn. Palo Alto, CA: Consulting Psychologists Press; 1983.
12. Klorman R, Weets T, Hastings J, Melamed B, Land P. Psychometric description of some specific fear questionnaires. Behav Ther 1974;5:401–9.
13. Aartman I, De Jongh A, Van der Meulen M. Psychological characteristics of patients applying for treatment in a dental fear clinic. Eur J Oral Sci 1997;105:384–8.
14. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. DSM-III-R. Washington: APA; 1987.
15. Roy-Byrne P, Milgrom P, Khoon-Mei T, Weinstein P, Katon W. Psychopathology and psychiatric diagnosis in subjects with dental phobia. J Anx Dis 1994;8:19–31.
16. Kleinknecht R, Klepac R, Alexander L. Origins and characteristics of fear of dentistry. J Am Dent Assoc 1973; 86:842–8.
17. Silva P, Stanton W, editors. From child to adult: The Dunedin Multidisciplinary Health and Development Study. Auckland: Oxford University Press; 1996.
18. Corah N. Development of a dental anxiety scale. J Dent Res 1969;48:596.
19. Corah N, Gale E, Illig S. Assessment of a dental anxiety scale. J Am Dent Assoc 1978;97:616–819.
20. Robins L, Helzer J, Croughan J, Ratcliff K. National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics and validity. Arch Gen Psychiatry 1981;38:381–9.
21. Robins L, Helzer J, Cottler L, Goldring E. Diagnostic Interview Schedule, Version III-R. Unpublished manuscript. St Louis: Washington University; 1989.
22. Newman D, Moffitt T, Caspi A, Magdol L, Silva P, Stanton W. Psychiatric disorder in a birth cohort of young adults: prevalence, comorbidity, clinical significance, and new case incidence from ages 11 to 21. J Consult Clin Psychiatry 1996;54:552–62.
23. McGee M, Feehan M, Williams S. Mental health. In: Silva P, Stanton W, editors. From child to adult: The Dunedin Multidisciplinary Health and Development Study. Auckland: Oxford University Press; 1996.
24. Kessler R, McGonagle K, Zhao S, Nelson C, Hughes M, Eschlemann S, et al. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: results from the National Comorbidity Survey. Arch Gen Psychiatry 1994;51:8–19.
25. Chapman T. Epidemiology of fears and phobias. In: Davey G, editor. Phobias: a handbook of theory, research and treatment. London: John Wiley and Sons; 1993.
26. Noyes R, Holt C, Woodman C. Natural course of anxiety disorders. In: Mavissakalian M, Prien R, editors. Long-term treatment of anxiety disorders. Washington, DC: American Psychiatric Press; 1996.
27. Gale E. Fears of the dental situation. J Dent Res 1972; 521:964–6.