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Abstract. Little attention has been given to the issue of the age of onset of dental anxiety, even though it may have a bearing on the origins of this type of fear. This study aimed to identify the age of onset of dental anxiety and to identify differences by age of onset with respect to potential etiological factors, such as negative dental experiences, family history of dental anxiety, and general psychological states. Data were collected by means of two mail surveys of a random sample of the adult population. Of 1420 subjects returning questionnaires, 16.4% were dentally anxious. Half, 50.9%, reported onset in childhood, 22.0% in adolescence, and 27.1% in adulthood. Logistic regression analyses indicated that negative dental experiences were predictive of dental fear regardless of age of onset. A family history of dental anxiety was predictive of child onset only. Adolescent-onset subjects were characterized by trait anxiety and adult-onset subjects by multiple severe fears and symptoms indicative of psychiatric problems. The three groups were similar in terms of their physiological, cognitive, and behavioral responses to dental treatment. However, adolescent- and adult-onset subjects were more hostile toward and less trusting of dentists. These results indicate that child-onset subjects were more likely to fall into the exogenous etiological category suggested by Weiner and Sheehan (1990), while adult-onset subjects were more likely to fall into the endogenous category.

Key words: dental anxiety, etiology, age, psychological factors.

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Introduction

Dentally anxious individuals are not a homogenous group but differ in terms of the origins and/or manifestations of their fears of dental treatment (Milgrom *et al.*, 1985). For example, Weiner and Sheehan (1990) suggested that they could be classified into two groups, exogenous and endogenous, with respect to the source of their anxiety. In the former, dental anxiety is the result of conditioning via traumatic dental experiences or vicarious learning, while in the latter, it has its origins in a constitutional vulnerability to anxiety disorders, as evidenced by general anxiety states, multiple severe fears, and disorders of mood. This classification suggests that not all dentally anxious subjects become fearful as a result of conditioning.

Evidence for the role of conditioning in dental anxiety, through either aversive experiences or family influences, has been provided by Shoben and Borland (1954), Lautch (1971), Kleinknecht *et al.* (1973), Berggren and Meynert (1984), Ost and Hugdahl (1985), Davey (1989), Milgrom *et al.* (1995), Locker *et al.* (1996a), and Poulton *et al.* (1997). Evidence for the role of additional severe fears and psychiatric problems has been provided by Fiset *et al.* (1989), Moore *et al.* (1991), and Roy-Byrne *et al.* (1994). However, to date, no study has addressed the relative contributions of negative experiences, familial attitudes, and general psychological states to dental anxiety.

One issue which may have a bearing on the origins of dental anxiety is that of age of onset (Marks and Gelder, 1966). In a study of six different types of phobia, Ost (1987) found significant differences in age of onset. Animal and blood phobias were largely acquired in childhood, social phobias in adolescence, and agoraphobia and claustrophobia in adulthood. Of some importance was the fact that these different ages of onset were associated with distinct modes of acquisition and differences in psychological characteristics.

The age of onset with respect to dental anxiety has received relatively little attention (Ost, 1987), largely because dental anxiety is usually viewed as a fear originating in childhood which persists into later life. However, two studies that have addressed this issue do not support this point of view. Ost (1987) studied a group of dental phobics and found that almost 20% reported onset after the age of 14 years. Similarly, a population-based study by Milgrom *et al.* (1988) found that 33.3% became anxious during adolescence or adulthood.

Apart from these data, little is known about variations in the age of onset of dental anxiety and its implications in terms of etiology. This paper reports the results of a study which aimed to: (1) describe the distribution of the dentally anxious population according to age of onset, and (2) identify differences by age of onset with respect to etiological factors such as negative dental experiences, family history, and general psychological states. The main hypothesis we tested was that child-onset subjects would be more likely to fall into the exogenous category described by Weiner and Sheehan (1990), having acquired their anxiety through conditioning experiences, while adult-onset subjects would be more likely to fall into the endogenous category and demonstrate a heightened constitutional vulnerability to anxiety disorders.

Methods

The design of the study, its data collection methods, and procedures for obtaining informed consent and ensuring confidentiality were approved by the University of Toronto's Human Subjects Certification process.

Survey procedures

The data were collected during the baseline phase of a longitudinal, population-based study of the epidemiology of dental anxiety. The target population for the study was all persons aged 18 years and over living in the City of Etobicoke, one of five municipalities which comprise Metropolitan Toronto. The sampling frame was the list of voters covering this community. Since this is compiled by a household enumeration procedure, it contains the names of approximately 97% of persons eligible to vote. A two-stage random-start systematic sampling procedure was used, with sampling fractions designed to give a sample of 6360 subjects.

Data were collected by means of two mail surveys based on the Total Design Method recommended by Dillman (1978). Initially, all 6360 subjects were sent a basic questionnaire on dental anxiety. To maximize the response rate, we sent three follow-up mailings. Subsequently, a 60% subsample of those completing the first questionnaire were sent a second questionnaire containing a number of psychological measures.

Measures

Dental anxiety. Dental anxiety was measured with Corah's Dental Anxiety Scale (DAS) (Corah, 1969), the Gatchel Fear Scale (Gatchel, 1989), and the single item used by Milgrom *et al.* (1988). Any subjects who scored 12 and above on the DAS, 8 or above on the Gatchel FS, or reported being very afraid or terrified of dental treatment were considered to be dentally anxious. This approach was adopted since each of these measures alone fails to identify some dentally anxious subjects (Locker *et al.*, 1996b). The Dental Fear Survey (DFS) (Kleinknecht and Bernstein, 1978) was used to assess the severity of dental anxiety. Subjects rated the amount of anxiety evoked by nine invasive and six non-invasive stimuli in the dental setting, using a six-point scale ranging from 1 (not at all) to 6 (very much).

Age of onset. Subjects were asked to indicate whether they became dentally anxious during childhood (12 years of age or less), adolescence (age 13 to 17 years), or adulthood (18 years and over).

Conditioning experiences. Questions were asked about negative experiences in the dental setting, such as events which were painful, frightening, or embarrassing, and the age at which they first occurred. The family history with regard to dental anxiety was assessed by items pertaining to fear of dental treatment on the part of each subject's mother, father, and siblings.

Psychological characteristics. General fearfulness was measured by a short form of the Fear Survey Schedule II (FSS II) (Geer, 1966). The degree of fear or anxiety created by each of 20 objects or events was rated on a scale ranging from 0 (none) to 6 (terror). Fears rated 5 or 6 were considered to be severe. Trait anxiety was assessed by the 20-item Speilberger Trait Anxiety Index (STAI) (Speilberger *et al.*, 1983). In response to each item, subjects rate how they generally feel using a four-point scale in which 1 indicates 'almost never' and 4 indicates 'almost always'. The 12-item version of the General Health Questionnaire (GHQ) (Goldberg and Williams, 1988) was used to measure the frequency of symptoms potentially indicative of psychiatric disturbance. This also uses a four-point response scale which varies according to each item. For each scale, scores were generated from the sum of the responses to each item. Subsequently, a cut-off of the mean score plus one standard deviation was used to differentiate between subjects who had 'high' and those who had 'low' scores.

Other characteristics. Physiological responses during dental treatment were assessed by six items from the DFS. These included events such as increases in breathing rate, increased heart rate, and feeling nauseous. Cognitive responses were measured by means of a 13-item scale concerning the negative thoughts subjects had prior to and during dental treatment (Kent and Gibbons, 1987). Behavioral responses to dental anxiety were measured by means of questions concerning the use of dental services, avoidance of dental care, canceling appointments, and failing to show up because of anxiety about dental treatment. The Dental Beliefs Survey (Milgrom *et al.*, 1985) was used to assess subjects' perceptions of four components of the dentist-patient relationship that have a bearing on dental anxiety; namely, communication, belittlement, lack of control, and trust.

Data analysis

Subjects were classified into one of four groups: (1) not dentally

anxious, (2) dentally anxious—childhood onset, (3) dentally anxious—adolescent onset, and (4) dentally anxious—adult onset. Two sets of analyses were undertaken, the first comparing the three dentally anxious groups with each other, and the second comparing each of these groups with the non-anxious. In this respect, those who were not dentally anxious were used as a normative or reference group. Chi-square tests were used to assess the significance of differences in proportions, and odds ratios and their 95% confidence intervals were used to indicate and compare the strengths of associations. The significance of differences in means was assessed with one-way analysis of variance. Logistic regression analysis was used to assess the independent effects of potential etiological factors on the probability of dental anxiety.

Results

Response

The initial questionnaire was completed by 3055 subjects. This represents 60.4% of the 5061 individuals presumed to be alive and living at the listed address. Of these, 1420 completed the second psychological questionnaire. Census data indicated that, when compared with the target population, subjects completing both questionnaires were somewhat older and better educated.

Age of onset

Using the definition cited above, we classified 16.4% (n = 233) of subjects as being dentally anxious. One half, 50.9% (n = 111), reported becoming fearful of dental treatment in childhood, 22.0% (n = 48) suffered onset in adolescence, and 27.1% (n = 59) became anxious as adults. There were no differences among the three groups in terms of gender. The mean (SD) ages of the three groups at the time of data collection were 45.1 (13.7) years, 43.8 (13.7) years, and 49.6 (14.9) years, respectively (ns: one-way analysis of variance). The mean (SD) age of the non-anxious reference group was 48.7 (16.6) years.

The mean (SD) DAS scores of the three groups were 14.1 (2.7), 13.7 (2.8), and 13.5 (2.7), respectively; these were not significantly different. However, those with child-onset dental anxiety reported significantly more distress than adolescent- and adult-onset subjects with respect to six of the nine DFS items concerned with invasive procedures and two of the six DFS items referring to non-invasive procedures. Consequently, those with child onset had significantly higher scores than the others on a scale constructed by summing the response codes to all 15 DFS items (means of 54.5, 49.7, and 48.0, respectively; $p < 0.01$, one-way analysis of variance).

Table 1. Age at first traumatic dental experience by dental anxiety status (%)

	Age at First Traumatic Dental Experience		
Dental Anxiety Status	Child	Adolescent	Adult
Not dentally anxious (n = 1187)	39.4	22.3	38.3
Child-onset (n = 111)	67.9	18.3	13.8
Adolescent-onset (n = 48)	31.1	46.7	22.2
Adult-onset (n = 59)	27.3	10.9	61.8

Differences in proportions between dentally anxious groups: $p < 0.0001$: Chi-square test.

Conditioning experiences and family history

Overall, 74.8% reported painful dental experiences, 30.7% experiences which were frightening, and 13.3% experiences which were embarrassing. There was an association between dental anxiety status and the age at which negative experiences were first encountered (Table 1). Those with child-onset anxiety were the most likely to have had their first experience in childhood, those with adolescent onset were the most likely to have had their first experience in adolescence, and those with adult onset were the most likely to have had their first experience as adults. For the non-anxious, the first negative dental experiences were more evenly distributed with respect to age.

There were no differences among the three groups of dentally anxious subjects in the proportions reporting negative dental experiences (Table 2). However, all three groups were significantly different from the non-anxious. Odds ratios, obtained by comparing each dentally anxious group with the non-anxious reference group, indicated that the association between aversive events and dental anxiety was strongest for the child-onset group (OR = 9.2) and weakest for the adult-onset group (OR = 3.7).

Age of onset of dental anxiety and family history of dental anxiety were associated (Table 2). Half (55.9%) of those with childhood onset had a mother, father, or sibling who was anxious about dental treatment compared with one-third (35.6%) of those with adult onset ($p < 0.05$). The associated odds ratios and their 95% confidence intervals indicated that a family history of dental anxiety was a predictor of child-onset anxiety only.

Psychological characteristics

Table 3 shows the proportions in each group with high scores on the three scales measuring general psychological states. The odds ratios and 95% confidence intervals indicate no differences between child-onset subjects and the non-anxious reference group. Adolescent-onset subjects were significantly different on two of the three measures, and adult-onset subjects were significantly different on all three. The odds ratios indicated that the associations were strongest for adult-onset subjects.

Independent predictors of dental anxiety by age of onset

Three logistic regression analyses were undertaken. The first compared child-onset subjects with the non-anxious reference group, the second compared the adolescent-onset sub-

jects with the reference group, and the third compared the adult-onset subjects with the reference group. The three types of negative dental experiences (painful, frightening, embarrassing) were entered as separate variables. Gender was included in the models as a control variable. All dependent and independent variables were in a binary format coded 0 and 1. The results are summarized in Table 4.

In the model predicting child-onset dental anxiety, only a family history of dental anxiety and the three variables describing aversive experiences entered the regression equation. For adolescent-onset anxiety, negative experiences and the score on the Trait Anxiety Index were significant predictors, while for adult-onset anxiety, frightening experiences and the scores on the FSS II and the GHQ emerged as significant predictors. These results tend to confirm the hypothesis being tested. Direct and vicarious conditioning experiences are important with respect to child-onset dental anxiety, while general psychological states play a more prominent role in adult-onset anxiety.

Table 2. Percent reporting one or more negative dental experiences and a family history of dental anxiety: Comparison of each dentally anxious group with the non-anxious reference group

Dental Anxiety Status	Percent Reporting Negative Dental Experiences			Percent Reporting Family History of Dental Anxiety		
	%	Odds Ratio	95% CI	%	Odds Ratio	95% CI
Not dentally anxious	74.4	1.0	—	35.4	1.0	—
Child-onset	96.4[a]	9.2	3.2-21.6	55.9[a]	2.3	1.5-3.5
Adolescent-onset	93.8[b]	5.2	1.5-15.8	47.9	1.7	0.9-3.1
Adult-onset	91.5[b]	3.7	1.4-10.7	35.6	1.0	0.8-1.8

[a] Differences in proportions between the dentally anxious group and the non-dentally anxious reference group significant: Chi-square test $p < 0.0001$.

[b] Differences in proportions between the dentally anxious group and the non-dentally anxious reference group significant: Chi-square test $p < 0.01$.

Other characteristics

There were no differences among the three groups in terms of physiological, cognitive, or behavioral responses to dental treatment. However, the Dental Belief Scale scores of the three groups (4.5, 5.9, and 5.9, respectively; $p < 0.05$, one-way analysis of variance) indicated that adolescent- and adult-onset subjects were significantly more negative concerning dentists and their behavior toward patients than were child-onset subjects.

Discussion

Although the response to the study was acceptable, there were differences between study subjects and the population from which they were drawn. The former were older and somewhat better educated than the latter. Since the magnitude and direction of bias induced by these differences are difficult to judge, some caution needs to be exercised when the results of the study are generalized.

Among the dentally anxious subjects identified in this population-based study, only half reported becoming dentally anxious in childhood. One-fifth reported adolescent onset, and almost one-third reported onset in adulthood. These results confirm the earlier observations of Milgrom *et al.* (1988) and challenge the view that dental anxiety is invariably a fear which has its origins in childhood. Although the DAS scores of the three groups were similar, scores derived from the Dental Fear Survey suggested that the anxiety of child-onset subjects was more severe than that of adolescent-onset and adult-onset subjects. This was largely due to the fact that the former reported significantly more anxiety with respect to stimuli associated with invasive dental procedures, such as restorations and the extraction of teeth. Kleinknecht and Lenz (1989) have suggested that since such treatments involve blood and body injury types of stimuli, these anxiety responses may be linked to blood and body injury fears, which typically arise in childhood (Ost, 1987). Such fears are characteristic of approximately one-third of dentally anxious adults (Locker *et al.*, 1997).

Rachman (1977) has suggested that three types of conditioning may play a role in the acquisition of fears. While many fears have their origins in direct experience, others

Table 3. Proportions with high scores on the three measures of general anxiety and fearfulness: Comparison of each dentally anxious group with the non-anxious reference group

Dental Anxiety Status	General Anxiety and Fearfulness					
	Fear Survey Schedule II		Trait Anxiety Index		General Health Questionnaire	
	%	Odds Ratio 95% CI	%	Odds Ratio 95% CI	%	Odds Ratio 95% CI
Not dentally anxious	15.3	1.0	12.5	1.0	7.7	1.0
Child-onset	21.6	1.5/0.9-2.5	16.2	1.4/0.7-2.4	12.6	1.7/0.9-3.3
Adolescent-onset	27.1[a]	2.1/1.1-4.1	27.1[b]	2.6/1.3-5.2	14.6	2.0/0.8-3.9
Adult-onset	42.4[c]	4.0/2.3-7.2	28.8[c]	2.8/1.5-5.3	23.3[c]	3.7/1.9-7.4

[a] Difference between the dentally anxious group and the non-anxious reference group significant; $p < 0.05$, Chi-square test.

[b] Difference between the dentally anxious group and the non-anxious reference group significant; $p < 0.01$: Chi-square test.

[c] Difference between the dentally anxious group and the non-anxious reference group significant; $p < 0.001$, Chi-square test.

Table 4. Results of the logistic regression analyses

Independent Variable:	Model 1 Child-onset *vs.* Reference Group		Model 2 Adolescent-onset *vs.* Reference Group		Model 3 Adult-onset *vs.* Reference Group	
	p	Odds Ratio	p	Odds Ratio	p	Odds Ratio
Family history of dental anxiety (Yes = 1; No = 0)	< 0.05	1.8	ns	—	ns	—
Painful dental experiences (Yes = 1, No = 0)	< 0.01	4.5	< 0.05	3.1	ns	—
Frightening dental experiences (Yes = 1; No = 0)	< 0.001	4.2	< 0.05	2.4	< 0.05	2.5
Embarrassing dental experiences (Yes = 1; No = 0)	< 0.05	2.2	< 0.05	2.8	ns	—
Fear Schedule Survey II score (High = 1; Low = 0)	ns	—	ns	—	< 0.05	2.6
Trait Anxiety Index score (High = 1; Low = 0)	ns	—	< 0.05	2.6	ns	—
General Health Questionnaire score (High = 1; Low = 0)	ns	—	ns	—	< 0.05	2.8
Sex (Male = 1; Female = 0)	ns	—	ns	—	ns	—
Model chi-square		87.4		38.1		38.0
df		8		8		8
p		< 0.0001		< 0.0001		< 0.0001

may arise *via* modeling or exposure to threatening information. This theory helps explain why not all fearful individuals have been exposed to a traumatic conditioning episode.

With respect to direct conditioning experiences, there were no differences among the three groups of dentally anxious subjects in terms of their reports of dental experiences involving pain, fear, or embarrassment. However, in both bivariate and multivariate analyses, the associated odds ratios indicate that such experiences made a greater contribution to child-onset anxiety than adult-onset anxiety. The multivariate analyses also suggested that while all three types of experiences were important with respect to the former, only frightening experiences were influential with respect to the latter. That child-onset subjects were more fearful of invasive procedures and adolescent- and adult-onset subjects more negative concerning dentists' behavior may also reflect differences in the types of conditioning experiences giving rise to dental anxiety (Locker *et al.*, 1996a).

Although there was an association between age of onset and age of first negative dental experience, there was a degree of discordance in each group of dentally anxious subjects with respect to the timing of traumatic experiences. Almost one-third of child-onset subjects reported that their first traumatic experience did not occur until adolescence or adulthood, and almost two-fifths of adult-onset subjects reported such experiences prior to becoming dentally anxious. Davey (1989), in exploring the latent inhibition hypothesis, has provided evidence to demonstrate that the relationship between traumatic experiences and dental anxiety is not a simple one. In his studies, traumatic experiences were more likely to give rise to dental anxiety if they occurred early in an individual's dental care history than if they were preceded by a series of relatively painless dental visits. While this explains why many non-dentally anxious subjects report traumatic dental experiences, it does not account for the patterns observed in this study. Milgrom and Weinstein (1993) have suggested that the consequences of traumatic experiences are dependent upon the context in which they occur. That is, pain inflicted by a dentist who is perceived as caring is likely to have less psychological impact than pain inflicted by a dentist who is cold and controlling.

These observations indicate that while direct conditioning experiences are important in the genesis of dental anxiety regardless of age of onset, factors other than trauma appear to be involved. Rachman's (1977) model of fear acquisition suggests that the family history of fears and phobias is important, while Weiner and Sheehan (1990) suggest that general psychological traits and states play a role.

In this study, a family history of dental anxiety was important with respect to child-onset anxiety only. This finding is consistent with the study by Ost (1987), who reported that phobias acquired in adulthood were less likely than those acquired in childhood to be ascribed to modeling and/or vicarious learning. It is also consistent with the findings of Milgrom *et al.* (1995), who found that direct conditioning and modeling were both important predictors of dental anxiety originating in childhood.

Bivariate and multivariate analyses of our data suggested that general psychological states and traits made a contribution to adolescent- and adult-onset anxiety but not child-onset anxiety. Adolescent-onset subjects were more likely to have high trait anxiety, while adult-onset subjects were more likely to have multiple severe fears and symptoms potentially indicative of psychiatric disorder. There is growing evidence that, for some dentally anxious adults, fears concerning dental treatment are linked to or symptomatic of broader psychological problems (Kent, 1997). The evidence

with respect to children is less clear, perhaps because appropriate measures have not been widely used in studies of children. Milgrom *et al.* (1995) found no association between dental anxiety and a measure of behavioral problems and social competency in children. However, studies have found a link between child temperament and anxiety regarding dental treatment (Liddell, 1990).

The role played by general psychological factors in the acquisition of dental anxiety appears to be a complex one. Davey (1997), in describing how contemporary conditioning models help explain the acquisition and maintenance of phobias, has suggested that they are associated with a tendency to focus on and rehearse the negative outcomes of encounters with feared objects and events. Since subjects with high trait anxiety selectively process threatening information, they inflate the unpleasantness of unconditioned stimuli and experience conditioned responses of a higher magnitude. Davey (1997) cites experimental evidence in support of this characterization of the way in which fears are induced.

The data presented here support the classification of dentally anxious subjects suggested by Weiner and Sheehan (1990) and indicate that child-onset subjects were more likely to be exogenous, while adult-onset subjects were more likely to be endogenous. There was, however, a degree of overlap in that all subjects were characterized by exogenous factors. Consequently, this classification scheme should be considered to be dimensional rather than categorical.

A major limitation of the study was its cross-sectional design. Even though the analysis approximated a case-control study, temporal relationships cannot be established. At best, we have documented associations between potential etiological factors and dental anxiety originating at different points in the life span. Even so, the associations between direct conditioning experiences and dental anxiety were based on subjects' retrospective reports, which may be subject to problems of recall and retrospective re-interpretation. For example, Kent (1985) found that dentally anxious patients reported more pain three months after treatment than was reported immediately following treatment. This reconstruction made their actual experiences more consistent with their anxieties and expectations about dental treatment.

These caveats also apply to the findings concerning the family history of dental anxiety. Although the data clearly suggest that negative attitudes on the part of the mother and/or siblings, and vicarious learning processes, make a greater contribution to child- onset dental anxiety than to adolescent- or adult-onset dental anxiety, problems of recall and retrospective re-interpretation may also have had an influence on these findings (Kent, 1989). Because of these problems, conclusions regarding the role of conditioning events and vicarious learning in the onset of dental anxiety are best framed as hypotheses rather than as definitive findings. Consequently, although the data are consistent with the view that the psychological characteristics of a subset of the population render them vulnerable to dental anxiety, the precise role of exogenous and endogenous factors, and the sequence in which they occur in groups defined by age of onset, can be elucidated only by means of longitudinal studies and qualitative research. It is entirely plausible, for example, that the psychological states which characterize adult-onset subjects are related more to the maintenance of dental anxiety than to its origins. In this regard, Liddell and Locker (1994) reported that adults who carried their dental anxiety into old age were more generally fearful than subjects who had been dentally anxious but recovered with aging.

Another implication of the study for research into dental anxiety is that greater recognition needs to be given to the fact that the dentally anxious population is not homogenous but is comprised of groups which differ along several psychological and other dimensions. If data are not analyzed specific to these subgroups, then important associations may be masked or attenuated. For example, when the logistic regression analysis was repeated comparing all dentally anxious subjects with the non-anxious reference group, a family history of dental anxiety and scores on the FSS II and the MHQ did not enter the model.

The main implication of this study for dental practice is that the dental team needs to take as much care with adult patients as with child patients and use appropriate communication techniques which enhance trust and feelings of control. This preventive approach may reduce the incidence of dental anxiety in psychologically vulnerable individuals. In addition, although child-onset subjects have more severe anxiety concerning dental treatment, adult-onset patients, because of their psychological characteristics and greater hostility toward dentists, may be more difficult for the practitioner to manage. Information on dental anxiety and age of onset, then, should be collected from dental patients so that dentists may plan an appropriate management and/or treatment strategy.

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