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Determinants of early- vs late-onset dental fear in a longitudinal-epidemiological study

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Abstract

A longitudinal investigation of risk factors for early- and late-onset dental fear was conducted. Early-onset dental fear was related to conditioning experiences (indexed via caries level and tooth loss), service use patterns, stress reactive personality and specific beliefs about health professionals. Late-onset dental fear was related to aversive conditioning experiences, irregular service use and an external locus of control. In contrast to recent findings for dental anxiety, personality factors were not strongly related to the onset of dental fear in young adulthood. The key role played by conditioning events in the development of both early- and late-onset dental fear was confirmed. Conditioning events appear to play a different role in the development of dental fear vs dental anxiety. This may reflect important, but largely ignored differences between these two closely-related constructs. Interventions for early-onset dental fear should aim to modify both the dental fear and the personality vulnerabilities that may contribute to the development of dental fear early in the life-course. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

The commonly held view that dental fear arises in youth and results from traumatic dental experiences (Kleinknecht, Klepac & Alexander, 1973; Lauth, 1971; Milgrom, Mancel, King & Weinstein, 1995; Shoben & Borland, 1954) may require revision (Locker, Liddell, Dempster &

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Shapiro, 1999). Locker et al. (1999) studied the closely-related construct of dental anxiety among a community study of adults (aged 18 years and over) and obtained data consistent with at least two alternate paths to dental anxiety (Weiner & Sheehan, 1990). The first pathway involved conditioning events and was associated with early onset of anxiety; a second pathway, typifying late-onset cases, was characterised by high levels of general fearfulness and trait anxiety and relatively few aversive conditioning events. Based on these findings, Locker and his colleagues suggested that the late onset anxiety group might be particularly difficult to treat as it comprises individuals with an apparent constitutional vulnerability to negative affective states. Similar findings regarding the relative redundancy of conditioning events in the development of late-onset dental anxiety have recently been reported from a longitudinal cohort study (Thomson, Locker & Poulton, 2000).

Establishing the role of conditioning events in early- vs late-onset dental fear would be of interest for both practical and theoretical reasons. For example, the belief that chronic fear (emerging early in the life course in vulnerable individuals) should be more difficult to treat (Fiset, Milgrom, Weinstein & Melnick, 1989; Roy-Byrne, Milgrom, Khoon-Mei, Weinstein & Katon, 1994) may no longer be justified (Locker et al., 1999). From the theoretical perspective, findings that demonstrate the irrelevance of conditioning processes in late-onset dental fear would be inconsistent with associative and non-associative accounts of fear acquisition, as both predict a relation between aversive events and the development of dental fear (Mineka & Zinbarg, 1995; Poulton, Waldie, Menzies, Craske & Silva, 2000; Rachman, 1977, 1991). Understanding the processes involved in fear acquisition is important for the development of effective interventions. Accordingly, the present study examined the role played by conditioning events (indexed by caries experience and tooth loss), dental service use patterns, personality traits and locus of control in the development of early- vs late-onset dental fear (Locker et al., 1999; Thomson et al., 2000).

2. Method

2.1. Participants

The sample consisted of members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal investigation of children born in Dunedin, New Zealand between 1 April 1972 and 31 March 1973 (Silva & Stanton, 1996). Briefly, the original sample ($n=1037$) has been assessed on a wide variety of psychological and medical measures at two year intervals from age 3 to 15, and subsequently at 18 ($n=993$), 21 ($n=992$), and most recently in 1998–99 at age 26 when 96.2% of the living cohort ($n=980$) was assessed.

2.2. Dental fear at age 11, 18 and 26

As part of the mental health assessment at age 11 (Costello, Edelbrock, Kalas, Kessler & Klaric, 1982), study members were asked “In the last year, have you worried about things before they happened (like going to the doctor, or having a test at school)?” If study members volunteered (i.e., unprompted) that they “always” worried about going to the dentist, they were classified as having dental fear ($n=26$, 3.3%). At age 18, study members were administered a modified version

of the Diagnostic Interview Schedule (DIS; Robins, Helzer, Cottler & Goldring, 1989). Study members were asked, “In the last year have you had a strong unreasonable fear of going to the dentist?” A response of “yes, definitely” to this question resulted in the classification of dental fear at age 18 ($n=96$, 9.5% of the total sample assessed at 18).

At age 26, the DIS for DSM-IV was administered (Robins, Cottler, Bucholz & Compton, 1995) and study members were asked if they had been fearful of going to the dentist in the 12 months prior to interview ($n=202$; 20.6%). The following groups were defined: (1) those without dental fear at age 11, 18 or 26 (controls $n=685$); (2) early-onset dental fear group (fear at both age 18 and 26) ($n=60$); or (3) late-onset dental fear group (fear at age 26 only) ($n=143$, 14.6%).

2.3. Dental assessment at ages 15, 18 and 26

Measures representing direct contact with dental treatment can be regarded as good indicators of conditioning experience (Milgrom et al., 1995; Poulton et al., 1997). Dental examinations were conducted using calibrated dental examiners and *Decayed Filled Surface* scores were calculated and used as indices of dental treatment experience. Data were available on cumulative caries experience up to the age of 15 ($n=868$), up to age 18 ($n=867$), and up to age 26 ($n=930$). Those who had lost one or more teeth due to caries between 18 and 26 were also identified ($n=85$). Wisdom teeth extractions were not included. Information about dental service use between ages 18 and 26 was obtained by asking study members how long it had been since their last visit to a dentist, and whether that visit had been for a check-up (i.e., “preventive user”, $n=443$) or a problem (“symptomatic user”, $n=513$).

2.4. Multidimensional health locus of control scale (MHLoC)

The MHLoC scale (Wallston, Wallston & DeVellis, 1978) was administered to 838 study members at the age 15 assessment. It includes three dimensions (five or six items rated on a four-point scale from “strongly disagree” to “strongly agree”) pertaining to perceived control over health. The Internal scale describes a personal sense of responsibility and efficacy with regard to one’s health (e.g. “My health depends upon how well I take care of myself”), the Chance scale describes a fatalistic attitude toward health outcomes (e.g. “If I get sick, it’s because getting sick just happens”) and the Powerful Others scale describes an external set of beliefs, specifically related to the importance of medical professionals for one’s health (e.g. “Getting to the doctor regularly is the best way for me to avoid getting sick”).

2.5. Multidimensional personality questionnaire (MPQ)

At the age 18 assessment, study members completed a modified version (Form NZ) of the MPQ (Tellegen, 1982). Rationale and description of the modifications of the MPQ for use in NZ (Krueger, Caspi, Moffitt, Silva & McGee, 1996) were approved by Tellegen. The MPQ is a self-report personality instrument designed to assess a broad range of individual differences in affective and behavioural style. The modified 177-item MPQ consists of 10 different subscales (Tellegen, 1982, pp. 7–8): Well being (11 items); Social Potency (18 items); Achievement (17 items); Social Closeness (19 items); Stress Reaction (14 items); Alienation (17 items); Aggression (18 items);

Control (20 items); Harm Avoidance (22 items); and Traditionalism (22 items). The MPQ has good psychometric properties (Krueger et al., 1996; Tellegen et al., 1988).

3. Results

Descriptive data and bivariate relations between the two dental fear groups (early- and late-onset) and the three families of independent variables used to predict dental fear (dental health and service use measures, health locus of control and personality measures) are presented in Table 1. Preliminary analyses revealed no sex differences.

Stepwise discriminant analysis was used to distinguish between those who became fearful of the dentist prior to age 18 (early-onset, analysis One), or after age 18 but before 26 (late-onset, analysis Two) vs those with no dental fear. Logistic regression analyses were conducted to quan-

Table 1

Mean values (SD) of dental health and service use, Multidimensional Health Locus of Control (MHLoC) subscales and Multidimensional Personality Questionnaire (MPQ) subscales as a function of Dental fear (no fear, early-onset fear, late-onset fear) in a representative cohort study

	No dental fear	Early-onset fear	Late-onset fear
Dental health & service use			
Caries (DMFS) up to age 15	4.04 (4.6)	6.1 (5.4) ^a	5.9 (5.6) ^a
Caries (DMFS) up to age 18	6.99 (6.8)	11.5 (9.4) ^a	9.9 (7.8) ^a
Caries (DMFS) up to age 26	10.28 (9.6)	15.4 (12.5) ^a	12.3 (10.7) ^a
Tooth/teeth lost due to caries ^b	53 (7.7)	9 (15.0) ^c	21 (14.7) ^a
Symptomatic service user ^b	330 (48.6)	41 (71.9) ^a	93 (71.0) ^a
MHLoC subscales			
Internal	3.02 (0.31)	3.02 (0.32)	2.94 (0.29) ^c
Chance	2.18 (0.34)	2.18 (0.33)	2.25 (0.39)
Powerful Others	2.44 (0.33)	2.60 (0.36) ^a	2.52 (0.34)
MPQ subscales			
Well Being	79.12 (20.1)	76.21 (22.5)	74.56 (22.5) ^c
Social Potency	38.02 (24.1)	37.13 (24.2)	35.76 (22.6)
Achievement	53.70 (21.6)	54.40 (18.1)	50.62 (20.6)
Social Closeness	79.68 (16.8)	77.87 (18.7)	76.04 (21.5) ^c
Stress Reaction	40.89 (28.0)	57.71 (22.8) ^a	43.63 (27.1)
Alienation	18.09 (18.4)	29.40 (24.6) ^a	23.73 (20.9) ^c
Aggression	33.34 (22.8)	35.54 (21.6)	36.07 (21.6)
Control	56.69 (23.4)	52.20 (18.2)	55.27 (21.0)
Harm Avoidance	61.01 (21.2)	67.18 (20.7) ^c	63.26 (20.9)
Traditionalism	64.02 (17.2)	65.18 (13.2)	62.34 (16.7)

^a $P < 0.01$ vs no dental fear.

^b The percentage of study members in each group with positive values are presented (where 0=no and 1=yes).

^c $P < 0.05$ vs no dental fear.

tify the strength of the relation between independent and dependent variables. The odds ratio (OR) and 95% confidence intervals (CI) are reported.

3.1. Early-onset dental fear

Stepwise selection revealed that four variables significantly contributed to the prediction of early-onset dental fear: (1) cumulative lifetime caries experience up to age 18; (2) being a symptomatic user of dental services; (3) the Powerful Others dimension of the MHLoC scale, and (4) the Stress Reaction subscale of the MPQ. This model classified 91.9% of cases correctly (Table 2).

Results of the logistic regression showed that study members who were nervous, vulnerable, sensitive and prone to worry were over seven times more likely to develop a dental fear by the age of 18 than those who were less reactive to stress. The likelihood of developing dental fear was twice as high for those who tended not to visit the dentist regularly or who experienced high levels of caries into late adolescence, and those who attributed good health to health professionals (rather than to themselves or chance factors).

3.2. Late-onset dental fear

Four variables were included in the final model, and correctly classified 82.2% of the late-onset dental fear cases: (1) cumulative lifetime caries experience up to age 15; (2) losing one or more teeth between 18 and 26 due to caries; (3) the Internal HLoC dimension; and (4) being a symptomatic user of dental services (Table 3).

The likelihood of developing dental fear in young adulthood more than doubled if one or more teeth had been lost due to caries and if more caries was experienced prior to mid-adolescence (Table 3). Study members with late-onset fear were also almost two times more likely than controls to be symptomatic users of dental services. Low scores on the Internal health locus of control scale significantly increased the risk of developing dental fear.

3.3. Early- vs late-onset dental fear

To determine if the two dental fear groups differed on lifetime experience of caries, a Group (3) by Caries experience (3) repeated measures analysis of variance was employed. Post hoc

Table 2

Results of the final stepwise discriminate model performed to predict early-onset dental fear among members of a longitudinal cohort study. Variables entered in the model included dental health and service use, three Multidimensional Health Locus of Control (MHLoC) subscales and 10 Multidimensional Personality Questionnaire (MPQ) subscales

Step	Wilks' lambda ^a	df1	df2	df3	Odds ratio ^b (95% CI)
1. MPQ Stress Reactivity	0.968	1	1	609	7.07 (2.9–17.1)
2. Caries to Age 18	0.943	2	1	609	2.00 (1.0–3.8)
3. "Powerful Others" MHLoC	0.924	3	1	609	2.30 (1.2–4.5)
4. Symptomatic Service User	0.916	4	1	609	2.13 (1.1–4.0)

^a At each step of the analysis, the variables that minimise the overall Wilks' lambda are entered.

^b The odds ratios presented are based on a median split of the data except in the case of Service Use.

Table 3

Results of the final stepwise discriminate model performed to predict late-onset dental fear among members of a longitudinal cohort study. Variables entered in the model included dental health and service use, three Multidimensional Health Locus of Control (MHLc) subscales and 10 Multidimensional Personality Questionnaire (MPQ) subscales

Step	Wilks' lambda ^a	df1	df2	df3	Odds ratio ^b (95% CI)
1. Caries to Age 15	0.976	1	1	664	2.02 (1.3–3.2)
2. Lost Tooth Due to Caries	0.961	2	1	664	2.27 (1.2–4.3)
3. "Internal" MHLc	0.950	3	1	664	0.44 (0.2–0.9)
4. Symptomatic Service User	0.941	4	1	664	1.69 (0.9–2.9)

^a At each step of the analysis, the variables that minimise the overall Wilks' lambda are entered.

^b The odds ratios presented are based on a median split of the data except in the case of Service Use.

analyses (LSD) on the significant Group×Caries interaction [$F(4,1620)=4.6$, $P<0.001$] revealed that study members with early-onset dental fear had significantly more cumulative caries experience up to age 26 ($M=15.2$, $SD=12.1$) than study members with late-onset dental fear ($M=13.3$, $SD=10.6$, $P<0.05$).

To assess whether the personality traits distinguished between early- vs late-onset dental fear individuals, the MPQ subscale scores were subjected to a multivariate analysis of variance. Only the Stress Reaction subscale of the MPQ was significant [$F(1,188)=11.9$, $P=0.001$], with the early-onset dental fear group having higher stress reactivity scores than the late-onset fear group.

The early- and late-onset dental fear groups did not differ on the Internal [$F(1,143)=3.4$, $P<0.10$] or Powerful Others [$F(1,143)=3.6$, $P<0.10$] dimensions of the MHLc scale.

4. Discussion

Early-onset dental fear was related to physical measures of poor dental health, service use behaviour, personality factors and specific beliefs about health professionals. In contrast, late-onset dental fear was most strongly related to aversive conditioning experiences (caries and tooth loss), symptomatic service use and an external sense of control. Notably, personality was not strongly related to the development of dental fear in adulthood, but caries experience before age 15 and tooth loss between 18 and 26 were. These findings provide support for the role of conditioning events in the acquisition of late-onset dental fear and suggest that the increased susceptibility to fear via vulnerable personality is more strongly related to the development of early-onset dental fear.

Our findings contrast with those reported for dental anxiety by Locker et al. (1999) and Thomson et al. (2000). The former study was based on cross-sectional data, with the attendant limitations of recall and re-interpretation, and lack of clarity with respect to temporal relationships (Henry, Moffitt, Caspi, Langley & Silva, 1994). However, the findings reported by Thomson and colleagues are more directly comparable, deriving as they do from the same cohort, during the same developmental period. They measured dental anxiety with the Corah (1969) Dental Anxiety Scale using the standard cut-off of ≥ 13 to define caseness, and found that new cases of dental anxiety (onset between age 18 and 26) appeared to be unrelated to caries experience or tooth loss

in the previous eight years. Perhaps the most obvious explanation for these different findings is that dental anxiety and dental fear may be related but distinct phenomena. Indeed, the general distinction between anxiety and fear is widely recognised (Craske, 1999; Gray & McNaughton, 1996; Rachman, 1998; DSM-IV, APA, 1994), yet it is often overlooked or ignored in the dental literature.

A subsequent examination of the concordance between dental fear and dental anxiety measures at age 26 in the Dunedin study confirmed our suspicion. That is, although the overall prevalence rates at age 26 for dental fear ($n=202$, 20.6%) and dental anxiety ($n=210$, 21.4%), were very similar, approximately only one half (55.1%) of those defined as dentally anxious using the standard DAS cut of ≥ 13 , also reported a dental fear. The lack of concordance remained irrespective of the cut-off score used for the DAS (i.e. ≥ 15 , 65.0%; $\geq 17=76.5\%$). Furthermore, similar results were obtained when the same analyses were repeated using dental anxiety and dental fear data obtained at age 18 (i.e., DAS $\geq 13=39.4\%$; $\geq 15=58.3\%$; and $\geq 17=63.6\%$). These findings are broadly consistent with research by Locker, Shapiro and Liddell (1996a). Clearly, the distinction between dental fear and dental anxiety is more than a semantic issue. Dental fear might be best viewed as the strong desire to avoid the fearful stimulus, whereas dental anxiety may be best characterised as anticipatory — a tendency to worry about dental treatment. In this sense, the relation between trait anxiety and adult onset dental anxiety reported by Locker et al. (1999) might be expected (Liddell, 1990; Locker, Shapiro & Liddell, 1996b). Notwithstanding, delineation of the similarities and differences between dental fear and dental anxiety is an important issue that deserves attention in future research (Humphris, Morrison & Lindsay, 1995; Locker et al., 1996a).

4.1. *Implications*

Acquisition of dental fear in young adulthood appears to be related to dental conditioning experiences that partially stem from a failure to adopt preventive dental health care practices. The importance of maintaining regular dental check-ups in young adulthood should remain a key message in dental health promotion. Paradoxically, the significant role played by conditioning processes in the development of adult onset dental fear may be cause for some optimism. That is, dental fear cases characterised by high levels of trait anxiety and/or other vulnerability factors tend to present a particular challenge for treatment and may require specialist professional input (Fiset et al., 1989; Locker et al., 1999; Roy-Byrne et al., 1994). Our results suggest that specialist intervention may not be necessary for late-onset dental fear if dental practitioners have adequate training and experience in application of behavioural techniques, or access to appropriate intervention materials (Milgrom, Weinstein, Kleinknecht & Getz, 1985).

From a theoretical perspective, the present findings are predicted by neo-conditioning models of fear acquisition (Rachman, 1991). Consistent with Mineka and Zinbarg's Stress-in-a-Dynamic-Context model of fear acquisition (Mineka & Zinbarg, 1995), we found that personality influenced the development of early-onset dental fear. The current findings are also consistent with non-associative models of fear acquisition which predict that an evolutionary-neutral fear (of which dental fear is prototypical) should be related to conditioning events (Poulton et al., 1997; Poulton et al., 2000).

The current findings underscore the relevance of conditioning events for late-onset fear and raise questions about the relevance of personality characteristics for that outcome. It appears that

some individuals may place themselves at risk for the acquisition of dental fear by only visiting the dentist when dental problems arise — a behavioural pattern consistent with an external health locus of control. Moreover, such a symptomatic pattern of dental service use is likely to result in more traumatic treatment [including tooth extractions (Thomson, Poulton, Kruger & Boyd, 2000)] which, among individuals with an external health locus of control, is likely to lead to further avoidance of treatment and maintenance and/or exacerbation of dental fear. This cycle is likely to be self-perpetuating if left unchecked and may ultimately result in worsening dental health and more pervasive impairment in social and occupational functioning (Weinstein, 1990; Eli, 1992).

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