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ORIGINAL ARTICLE

Dental anxiety in 18-year-old Norwegians in 1996 and 2016

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ABSTRACT

Objective: To estimate the prevalence of dental anxiety, and to explore factors that may increase the risk of reporting dental anxiety among 18-year-old Norwegians in 2016. A further objective was to report changes in dental anxiety since 1996.

Material and methods: An anonymous survey from a strategic sample of upper secondary students ($n = 351$) in 2016 with high response rate (93%) was compared with the results of an investigation of a similar population conducted in 1996.

Results: The prevalence of dental anxiety and dental distrust was reduced from 1996 to 2016. Dental Fear Survey (DFS) from 19 to 8% ($p < .001$), and Dental Belief Survey (DBS) from 15 to 6% ($p < .001$). Geer Fear Scale (GFS) which measure phobic anxiety did not show a similar reduction (17 versus 15%, $p = .37$). Phobic anxiety, avoidance behaviour, self-reported poor oral health and previous experiences of pain were all associated with dental anxiety.

Conclusion: The prevalence of dental anxiety was reduced from 1996 to 2016, but 8% still report dental anxiety. Proper pain management and use of behavioural management techniques still needs to be highlighted to prevent development of dental anxiety, avoidance behaviour and poor oral health.

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Dental fear and anxiety; pain; adolescents; prevalence

Introduction

Dental anxiety is a common issue among patients of all ages, but the origin of dental anxiety commonly starts in early childhood and adolescence [1–3]. Most children who are afraid of dental treatment will later learn to cope with this fear and 'grow out of it'; however, a few will later develop dental anxiety [4–7].

The prevalence of dental anxiety may be of special interest during late adolescence as individuals with persistent dental anxiety are at risk of longer periods of avoidance behaviour. The period from 18 to 30 years is a time when individuals transition from being a child/adolescent and still under parental care to a supposed responsible adult. During this time period, individuals may often postpone tasks such as dental treatment [8]. Studies from dental fear clinics demonstrate that patients with dental fear often avoid dental treatment from late adolescence and are led into the vicious circle of dental anxiety [8–10]. When patients with dental anxiety finally seek dental treatment, their dental health status is often negatively affected [8,11]. If dental health teams had identified dental fear in these patients during late adolescence, there would still have been time to treat the fear before this avoidance period started [8].

A previous study on the prevalence of dental anxiety in Norwegian adolescents revealed high dental fear and anxiety with an estimate of 19% in 1996 [12]. A recent study found a dental anxiety prevalence of 12% in 16-year-old adolescents in northern Norway [13], and a follow-up on the same population at 18 years of age showed no change in the percentage of dental anxiety in those 2 years [14]. Few studies have however followed the prevalence of dental anxiety in two comparable populations in the same geographical area in a longer time perspective. A Norwegian study on dental anxiety changes in 25-year-olds from 1997 to 2007 revealed only a minor decrease in dental anxiety from 17.5 to 16.7%, but the follow-up study had a very low response rate (19%) [15]. A study among adolescents from Jønkøping in Sweden conducted at regular intervals since 1973 revealed a significant decrease in dental anxiety in the last 30 years from 38% in 1973 to 13% in 2003 [16]. Reporting changes in prevalence in follow-up studies are therefore of importance, both to gain more knowledge of dental anxiety, but also to increase the knowledge of the possible mechanisms behind the prevalence change.

More behavioural management techniques (BMT) are currently available in the treatment of dental fear patients. Thus, one would expect that dental anxiety in children and adolescents should decrease accordingly. A previous study in Norway demonstrated that dentists in the Public Dental Service used a wide range of BMTs when treating children and adolescents with dental fear and anxiety [17]. The same study showed that the public dentists believed that approximately 11% (median) and 18% (mean) of their young patients had dental fear and anxiety, which indicates that dental anxiety is still a major issue for dental practitioners.

The development of dental anxiety has a number of known risk factors [4,18]. As dental anxiety is a multifaceted

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condition; there are many different indications on how some develop this anxiety while others do not [6]. Among the most reported possible aetiological risk factors are whether the child had been fearful [19], the temperament of the child [20], the child's family dental fear and anxiety [6,18,21] and if the child has low confidence in their dentist [22]. The most significant finding in some earlier studies is the experience of pain at earlier dental treatment [18,23]. Skaret et al. [12] demonstrated that having experienced pain in a dental situation at an early age increased the risk of dental fear and anxiety by tenfold. In a recent study, dentists reported that treating small children was very stressful and that several of them performed dental treatments without the use of local anaesthesia [24], even though proper pain control can be managed with the use of anaesthetics [25]. The belief that young patients do not feel the same pain as adults has been refuted [26], and without proper analgesia some patients will be at risk of reporting dental anxiety later in their life [12].

The dental caries situation in the Scandinavian population has improved in the recent decades [27]. The Public Dental Service (PDS) in Norway provide all children and adolescents from 0 to 18 years of age with free dental care. There have been few changes to the services provided by the PDS in Norway the last 20 years, apart from an extension and individualisation of recall intervals due to lower caries prevalence [28]. Most children and adolescents have little or no caries experience [29,30], whereas some still have a large caries burden and carry it with them as adults [31]. Thus, it could be hypothesized that the prevalence of painful experiences with dental treatment and, consequently, dental anxiety in adolescents has decreased.

The aims of this study were to (i) estimate the prevalence of dental anxiety in 18-year-old upper secondary students in Norway in 2016, (ii) explore factors that may increase the risk of reporting dental anxiety in 2016 and (iii) compare differences in dental anxiety between 1996 and 2016.

The null hypothesis was set with no difference in dental anxiety among adolescents in 2016 compared with 1996.

Materials and methods

Sample

To replicate the population in the study of Skaret et al. [12], the study group was selected from a strategic cluster sample of young adults (18 years) attending upper secondary school in Akershus County in 2016–2017. The sample was strategically selected to match the 1996 study, and eight upper secondary schools from the three main regions of the county were invited. Upper secondary schools in Norway are for the most part public schools, and they are divided into two lines of study. Theoretical education provides the students with the opportunity to continuing education in a College or University, while vocational education normally provides the students with an occupation (hairdresser, mechanic, electrician). The participants were randomly selected by the headmaster of the upper secondary schools using a clustering method (different classes), and it was aimed to recruit an equal amount of participants from each line of study. Given that there are more male students in the vocational studies, this survey has slightly more male participants. According to Official Statistics, Norway approximately 93% of all 16–18 year olds attend upper secondary school, and the students in this study were comparable in proportionality to the student population as a whole in Norway [32].

A power analysis based on the mean Dental Fear Survey (DFS) was conducted. With a 10% decrease in the mean DFS score over the last 20 years and a power level of 0.8, the sample size needed to include at least 243 participants. To ensure enough participants and completed questionnaires, 377 students were asked to participate in this study. All participants received free dental care in the Public Dental Service (PDS) at the time of the study.

Survey methods

The questionnaires were completed in the participants´ classrooms under supervision of master students in dentistry or a PhD student who were available for questions. The participants were informed of the purpose and anonymity of the study and that it was entirely voluntary to participate, that they could leave or withdraw at any time and that if they did not want to finish the form they could leave it completely empty or half-finished. The participants were not allowed to consult each other during the completion of the questionnaire, and left the classroom after returning the questionnaires. Students missing 20% or more of one of the psychometric forms were excluded from the study.

Survey instruments

The general questionnaire included data on demographics, such as age, gender and type of study (theoretical/vocational). It also included a question on parents' highest level of education (primary school, upper secondary school or higher education).

Dental Fear Survey was used as the main outcome for dental anxiety [33]. This 20 item questionnaire with a five-point Likert format records behavioural, psychological and cognitive self-reports to specific dental procedures with a range from 20 to 100. Each question is scored from 1: 'low fear' to 5: 'very high fear'. A DFS score of 60 or above was used as cut off for high DFS, indicating dental anxiety [33].

The Dental Belief Survey (DBS) consists of 15 items with a five-point Likert scale ranging from 1: 'highly positive beliefs' to 5: 'highly negative beliefs'. The DBS assesses the attitudes towards the dentists and how they deliver dental treatment and measure the participants' feelings of lack of security and trust [33]. The sum score ranges from 15 to 75. A DBS score of 48 or greater has been classified as high DBS, indicating distrust towards the dentist and dental anxiety [12].

Similar to the 1996 study, general phobic anxiety was assessed with a modified version of The Geer Fear Scale (GFS) [34]. The GFS assesses 18 items specific situations (e.g. height, darkness, blood) in scale with a seven-point Likert scale ranging from 'Not afraid at all' to 'Totally terrified'. The sum score varies between 18 and 126 and the cut-off point

Table 1. Sample size, education and gender in 1996 and 2016.

	Female *n* (%)	Male *n* (%)	Sum *n* (%)
1996			
Theoretical education	182 (59%)	154 (58%)	336 (59%)
Vocational education	124 (41%)	110 (42%)	235 (41%)
Total	306 (54%)	264 (46%)	571 (100%)
2016			
Theoretical education	98 (68%)	97 (48%)	196 (56%)
Practical education	47 (32%)	105 (52%)	152 (44%)
Total	145 (42%)	202 (58%)	347 (100%)

for high GFS was, like in the 1996 study, set at 56 or higher [12].

A question on dental anxiety in the participants' family was asked: 'Is anyone in your family afraid of dental treatment?'. The following answers were options: 'none afraid', 'mother afraid', 'father afraid', 'sibling afraid' or 'several family members afraid'. The answers were dichotomised into 'no family dental fear' (none afraid) and 'family dental fear' (mother afraid, father afraid, siblings afraid and several family members afraid).

To assess the participants' avoidance behaviour, the question from the 1996 study was used. The question: 'Have you in the last three years ever cancelled or not attended a dental appointment?' was answered with the options: 'No', 'Yes, because I was afraid' and 'Yes, because I didn't bother to go'. To calculate dental avoidance behaviour the answers were dichotomised into 'no avoidance behaviour' (no) and 'avoidance behaviour' (Yes, because I was afraid and Yes, because I didn't bother to go).

The participants' opinion about their own oral health was explored with the Locker's Global Oral Health item [35] 'What is your opinion of your oral health?'. The four possible responses: 1: 'very good oral health', 2: 'good oral health', 3: 'poor oral health' and 4: 'very poor oral health', were dichotomized into 'good oral health' (very good, good) and 'poor oral health' (poor, very poor).

The treatment that the participants had received at their last dental appointment was explored by the question: 'What treatment did you receive at your last dental appointment?' The four alternatives were dichotomised into 'examination' and 'treatment' (filling, extraction, other treatment).

Experience of pain at their last dental appointment was examined by the question: 'Did you experience pain at your last dental treatment?' Four answers were dichotomized into 'no pain' (not at all, insignificant) and 'pain' (yes; a little; and yes, very much).

Previous experiences of pain were explored by the question: 'Have you ever experienced pain at a dental treatment?' with three alternatives dichotomized into 'no previous painful dental treatments' (no painful dental treatments) and 'previous painful treatments' (one very painful dental treatment or several painful dental treatments).

Statistical analysis

The data were analysed using the statistical program SPSS (version 25). Missing values on single items of the psychometric scales (DFS, DBS and GFS) were replaced with the mean of the other items in that form. If greater than 20% of the items were missing from any scale, the participant was excluded from the dataset.

Group differences were analysed with one-way ANOVA. The relationship between variables were analysed using a Chi-square test with Pearson's correlation, while the correlation between the psychometric questionnaires were compared with Spearman. The relationship between high dental anxiety (DFS $\geq$ 60) and statistical significant factors related to its aetiology were analysed by multivariate logic regression. Risk estimates (odds ratio) for high dental anxiety were analysed in cross tables and compared with results from 1996. The level of significance was set to 0.05.

The study was approved by the Norwegian Social Science Data Service (NSD) (project number 40043).

Table 2. Multivariate logistic regression analysis of statistical significant factors related to dental anxiety (DFS $\geq$60) in 2016.

		Risk of reported DFS $\geq$ 60			
Variable	Total *n* (%)	DFS $\geq$ 60 *n* (%)	OR	95% CI	*p*-value
Gender					
Male (ref)	200 (58%)	9 (4%)			
Female	145 (42%)	19 (13%)	3.2	1.0–10.0	.051
High phobic anxiety (GFS $\geq$ 56)					
No (ref)	293 (85%)	15 (5%)			
Yes	52 (15%)	13 (25%)	4.1	1.5–11.0	.005*
Avoidance behaviour					
No (ref)	302 (88%)	15 (5%)			
Yes	43 (13%)	13 (30%)	7.4	2.7–20.5	<.001*
Oral health					
Good (ref)	316 (92%)	18 (6%)			
Poor	29 (8%)	10 (33%)	8.6	2.6–28.7	<.001*
Previous pain experience(s)					
No (ref)	174 (50%)	4 (2%)			
Yes	171 (50%)	24 (14%)	3.8	1.2–12.3	.025*

Nagelkerke R^2: 0.39. Ref = reference category.
*Statistical significant.

Results

A total of 377 students were invited. Twenty-six participants were excluded due to incorrect completion of the questionnaire (over 20% missing of any psycomethric questionnaire). Response rate was 93% (351 participants, 58% males (204) and 42% (146) females (one person did not report gender). The sample distribution according to education and gender in 1996 and 2016 are shown in Table 1. Concerning line of education 56% (196) were enrolled in theoretical and 43% (152) in vocational studies (3 did not answer). Female participants were more likely to study theoretical studies compared with male participants (68 versus 48%, $p < .001$). This finding corresponds with findings from Official Statistics Norway (56% female in theoretical and 42% in vocational studies) [32].

Prevalence of dental anxiety in 2016

High DFS (DFS $\geq$ 60) was registered in 8% ($n = 28$). Females were more likely to have high DFS than males (13 versus 4%, $p = .003$). A multivariate logic regression analysis of statistical

significant risk factors associated with dental anxiety (high DFS) is shown in Table 2.

Only 6% ($n = 20$) of the students scored high on DBS (DBS $\geq$ 48), with female students being more likely to report high DBS than male students (8 versus 4%, NS). Fifteen percent ($n = 52$) scored high on GFS (GFS $\geq$ 56), with the majority being female (83 versus 17%, $p < .001$). There were no differences in DFS, DBS or GFS when comparing the participants' education in attending vocational or theoretical studies. A summary of statistical significant findings between answering yes to different risk factors and DFS, DBS, GFS and gender are shown in Table 3.

There was a statistical significant correlation between the participants who reported a high DFS score and a high DBS score (Spearman correlation 0.43, $p < .001$). There was also a minor, but statistically significant level of correlation between the students who reported a high DFS score and a high GFS score (Spearman correlation 0.26, $p < .001$).

Dental anxiety in the family

Dental anxiety in the family was reported by 19%. For those with a high DFS score, 42% reported one or more family members with dental anxiety, while only 17% of those with lower DFS score reported the same ($p = .002$).

Avoidance behaviour

Most of the participants attended their dental appointments, and only 13% ($n = 44$) had ever cancelled or not attended a given appointment the last three years. Participants with high DFS were more likely to not attend an appointment than the low dental anxiety students (46 versus 10%, $p < .001$). The students with an avoidance behaviour were also far more likely to report poor oral health compared to the students with no avoidance behaviour (25 versus 6%, $p < .001$).

Locker's global oral health item

Nine percent of the participants reported poor oral health ($n = 30$). The participants with high DFS more frequently reported poor oral health compared with participants with low DFS (36 versus 6%, $p < .001$). The participants who reported poor oral health were also more likely to distrust their dentist than the students which reported good oral health (30 versus 7%, $p < .001$).

Treatments

The most common treatments the participants received at their last dental appointment were a routine dental examination (71%) or dental fillings (22%). Participants with a high dental anxiety were more likely to have undergone treatment at their last dental visit compared to participants with low dental anxiety (46 versus 27%, $p = .03$).

Pain at last dental visit

Of all the participants, 22% ($n = 76$) had experienced painful procedures the last time they attended a dental appointment. Treatments other than routine dental examination was considered more painful, with 50% of the participants reporting pain at a dental treatment while 10% reporting pain at a routine dental examination ($p < .001$). The participants with high DFS were more likely to report a painful procedure than the participants with low dental anxiety (61 versus 18%, $p < .001$). For 33% ($n = 25$) of those who reported pain at last treatment, a dental examination was the only procedure performed. Using chi-square statistics the patients who reported pain at examination statistical significantly also reported more dental anxiety in the family, avoidance behaviour, poor oral health, previous experiences of pain at the dentist, high dental fear, high distrust and high phobic anxiety compared to the patients who did not experience any pain at examination.

Pain at previous dental visits

During childhood, 50% of the participants had never had any painful experiences at the dentist, 33% had one single painful treatment and 17% had several painful experiences. The participants with high DFS score were more likely to have experienced one or more painful treatments than the participants with lower DFS (86 versus 47%, $p < .001$).

Changes in dental anxiety, dental distrust and phobic anxiety between 1996 and 2016

Both the prevalence of high DFS score and high DBS score exhibited statistical significant reductions over the last 20 years: DFS (19 versus 8%, $p < .001$), DBS (15 versus 6%, $p < .001$). These changes indicate a major reduction in both dental anxiety and dental distrust. The prevalence of high GFS score did not show a similar statistical significant reduction (17 versus 15%, $p = .37$).

To compare with the 1996 study, the mean sum scores for DFS, DBS and GFS in 2016 are presented in Table 4. A statistically significant reduction in dental anxiety was measured by both DFS [−9.4 (SD: 1.12), $p < .001$] and DBS [−7.6 (SD: 0.78), $p < .001$]. The gender differences were significant with females reporting higher sum scores for DFS in both 1996 and 2016. For DBS, females reported significantly higher sum scores only in 2016.

GFS showed a significant reduction in sum score from 1996 to 2016 (41.2 (SD: 14.3) versus 38.2 (SD: 16.1), $p = .003$), but this reduction was only shown for the male students when divided into genders. The difference between genders was statistically significant ($p < .001$) in both 1996 and 2016, with female students reporting higher sum scores of GFS in both surveys.

Table 3. A summary of associations between answering yes to different risk factors and DFS, DBS, GFS and gender in 2016.

	Family dental fear *n* (%)	Avoidance behaviour *n* (%)	Poor oral health *n* (%)	Pain last treatment *n* (%)	Previous pain experience(s) *n* (%)
Low DFS < 60 (ref)	**56 (17%)**	**31 (10%)**	**20 (6%)**	**59 (18%)**	**150 (47%)**
High DFS ≥ 60	**11 (42%)**	**13 (46%)**	**10 (36%)**	**17 (61%)**	**24 (86%)**
Low DBS < 48 (ref)	**55 (17%)**	**35 (11%)**	**24 (7%)**	**63 (19%)**	**157 (48%)**
High DBS ≥ 48	**12 (63%)**	**9 (45%)**	**6 (30%)**	**13 (65%)**	**17 (85%)**
Low GFS < 56 (ref)	**49 (17%)**	36 (12%)	25 (8%)	**54 (18%)**	**138 (47%)**
High GFS ≥ 56	**18 (35%)**	8 (15%)	5 (10%)	**22 (42%)**	**36 (69%)**
Male *n* = 202 (ref)	**30 (15%)**	27 (13%)	**23 (11%)**	39 (19%)	**85 (42%)**
Female *n*= 145	**37 (26%)**	17 (12%)	**7 (5%)**	36 (25%)	**89 (61%)**

Chi-square statistics. Statistical significance $p < .05$ are marked in bold. Ref: reference.

Table 4. Mean sum scores (DFS, DBS and GFS) in 1996 and 2016.

		Total mean (SD)	Female mean (SD)	Male mean (SD)	Statistical significance between genders
1996	DFS	43.6 (17.3)	48.0 (18.4)	38.5 (14.6)	$F = 44.84$, $p < .001$
	DBS	33.4 (11.8)	34.1 (12.4)	33.8 (11.0)	NS
	GFS	41.2 (14.3)	47.4 (13.8)	34.1 (11.1)	$F = 151.82$, $p < .001$
2016	DFS	34.2 (15.3)	40.5 (17.6)	29.7 (11.8)	$F = 47.05$, $p < .001$
	DBS	25.8 (11.1)	28.3 (12.1)	24.1 (10.1)	$F = 12.81$, $p < .001$
	GFS	38.2 (16.1)	48.0 (16.3)	31.3 (11.9)	$F = 122.34$, $p < .001$

Risk factors for dental anxiety

A comparison of risk estimates shown to be important for reporting high DFS score in 1996, are presented with updated data from 2016 in Table 5. Participants with a high GFS score and previous experiences of pain still have a high risk of reporting high dental anxiety, but other factors seem to be more important in 2016.

Discussion

Dental anxiety is still an issue among Norwegian 18-year olds as about 8% still report dental anxiety. The main hypothesis of the study was that there would be no difference in dental anxiety between 1996 and 2016. This null hypothesis is rejected. Dental anxiety in 18-year-old Norwegians has decreased significantly over the last 20 years and fewer than 1 in 10 Norwegian 18-year-olds are now afraid of receiving dental treatment. This finding is consistent with findings from Sweden [16], and comparable to a study from Northern Norway [14]. The lack of security and trust in dentists was also significantly reduced and show that few students now distrust their dentist.

The reasons for these reductions may be many. Lack of security and lack of confidence in the dentist have been shown to be associated with the development of dental anxiety [12]. This correlation between DFS and DBS was also shown in this study, where the majority of the participants with high dental distrust also had high dental anxiety. Since only a few students showed high degree of distrust towards their dentist in 2016, this could indicate that dentists now have more focus upon making children and adolescents safe and trustful during dental treatment in 2016 than they had in 1996. This supports the findings in a study from Norway describing dentists' attitudes and use of BMTs, where the majority of dentists had positive attitudes towards this patient group and used a wide specter of BMTs [17].

However, 8% of students still report dental anxiety. These students should be identified as early as possible to prevent development of dental phobia and dental avoidance behaviour as adults [10]. It was shown that high phobic anxiety, avoidance behaviour, self-reported poor oral health and previous experiences of pain were all statistical significant in the multivariate logistic regression analysis predicting high dental anxiety in 2016. A focus on these risk factors may increase the dentists' awareness of dental anxiety and may contribute to further lower the prevalence of patients who develop dental anxiety.

First, high phobic anxiety was a significant finding. Students with high GFS were more likely to report dental anxiety. Previous studies has shown a correlation between general anxiety and depression and dental anxiety [36,37], and especially female students were more prone to develop both anxiety disorders. A repeated cross-sectional study with similar design as the current study found that approximately 21% of female students and 7% of male students in Norway have high generalised anxiety [38], which is in accordance with this study. With this context in mind, the importance of dentist's use of BMTs to prevent dental fear development in young patients with high general phobic anxiety, should be highlighted [19]. Dental anxiety in the family has previously been shown to be a contributing factor to the development of dental anxiety [12,39]. This was confirmed in this study, and demonstrates that social influence from home can alter perceptions about dental treatment. Gender differences also seem to sustain, even though the multivariate logic regression analyses did not show a clear statistical significance between dental anxiety and gender. The statistical significance ($p = .051$) was however just slightly above the appointed level of significance ($p < .05$). Due to the low prevalence of dental anxiety in this study, a larger sample may have changed this significance, but it may also be that other factors than being female are more important in the development of dental anxiety.

Secondly, this study shows that few students cancelled or eschewed their appointed dental visits, but those with dental anxiety were far more likely to avoid dental appointments. This sort of avoidance behaviour has been reported in previous studies [40,41]. Patients with dental anxiety often have problems with attending dental treatments, and may also have difficulties taking care of their oral health [11]. Students with dental anxiety may therefore develop poor oral health [8,9,42] which could lead into a vicious circle of avoidance and neglect [8]. The students who reported poor oral health

Table 5. Risk estimates (odds ratio) for DFS ≥ 60 in 1996 and 2016.

			95% confidence interval	
	Risk factor	OR	Lower	Upper
1996	More than one painful experience	9.9	5.95	16.58
	High phobic anxiety (GFS > 55)	5.3	3.25	8.63
	More than one painful experience and high GFS	11.1	5.80	21.31
	More than one painful experience	**6.8**	**2.31**	**20.05**
2016	High phobic anxiety (GFS > 55)	**6.3**	**2.80**	**14.25**
	More than one painful experience and high GFS	**6.5**	**2.61**	**16.34**

Statistical significance $p < .05$ marked in bold. p values from 1996 not available.

in this study were shown to be far more likely to avoid dental treatment, and were also more distrustful towards their dentist. To reduce non-attendance in the Public Dental Service, it should therefore be acknowledged that many adolescents might be afraid of dental treatment, even examinations. Thus, clinicians should first aim to reduce the dental anxiety.

Finally, this study confirms that pain is still an important factor in the development of dental anxiety. The fact that students who experienced pain at the dental office were more prone to develop distrust of dentists is understandable. Pain will always be subjective, but this study demonstrates that the risk of reporting dental anxiety increases with previous pain experiences during dental treatment. Pain and anxiety are self-reinforcing, and important for the clinicians to keep in mind [43]. The use of proper pain management when treating patients is therefore of importance [25,26]. Interestingly, 33% of the participants who reported pain at their last dental visit, had an oral examination as their last dental appointment. When investigating the students who experienced pain at an oral examination, they were far more likely to report several signs and risk factors of dental anxiety compared to the students who did not. Extra care and respect for pain experiences should therefore be applied in all phases of dental treatment [43]. This study support the findings from Nermo et al. [14] which demonstrated that adolescents with high dental anxiety, self-reported poor oral health and previous pain experiences were more likely to increase their dental anxiety from 16 to 18 years of age than other adolescents. All these findings highlight the need of training dentists in use of BMTs and proper pain management.

A limitation of this study may be that even though the sample size is adequate, more female students, especially those in vocational studies, would have been preferred. Another limitation is that this survey only targets adolescents who attend upper secondary school. The 7% who do not attend upper secondary school in Norway are therefore not included. Both these limitations may have led to a lower reported prevalence of dental anxiety. The strengths of the study are the high response rate (>93%), which is rare, and the similarity of the populations in 1996 and 2016 given that the upper secondary schools are from the same county and districts. In addition, the anonymous nature of the study made it easier for the participants to answer without fear of being disclosed.

In conclusion, the prevalence of dental anxiety has been reduced from 1996 to 2016, but 8% of adolescents still report dental anxiety. This indicates that while fewer patients develop dental anxiety through their childhood, it still remains as an issue for dental health services. High phobic anxiety, avoidance behaviour, self-reported poor oral health and previous experiences of pain were all associated with dental anxiety. Proper pain management and adequate use of BMTs therefore still needs to be highlighted to prevent development of dental anxiety, avoidance behaviour and subsequently poor oral health.

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