The association of parental dental anxiety and knowledge of caries preventive measures with psychological profiles and children's oral health

L. Gavic[1], A. Tadin[1], A. Matkovic[2], K. Gorseta[3], S. K. Sidhu[4]

Study of Dental Medicine, School of Medicine, University of Split, Split, Croatia
[1]Assistant Professor
[2]6th year student
[3]Assistant Professor, Department of Paediatric Dentistry, School of Dental Medicine, University of Zagreb, Zagreb, Croatia
[4]Queen Mary University of London, Barts & The London School of Medicine and Dentistry, Institute of Dentistry, Centre for Oral Bioengineering London, United Kingdom

E-mail: lgavic@mefst.hr

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Abstract

Aim As parents and caregivers are responsible for the oral health of children, their own dental anxiety may negatively impact the oral health of their children.

This study aimed to assess whether parental dental anxiety and knowledge of caries preventive measures are associated with their psychological profiles and their children's oral health.

Methods This case-control study involved parents, who were divided according to whether their children did or did not have active caries. The differences in Short version of the Dental Anxiety Inventory, and Knowledge of Caries Preventive Measures (KCPM) scores between the parents whose children have and do not have active caries was established by the Mann-Whitney U test ($P < 0.05$).

Results The Mann-Whitney U test did not show any statistically significant difference in the S-DAI test or KCPM of parents regardless of whether their children had active caries or not. The number of active caries in children was statistically significantly affected by parental age (ß = 0.156, P = 0.002), education level (ß = - 0.742, P = 0.014), employment status (ß = - 1.410, P = 0.028), dental anxiety level (ß = - 0.048, P = 0.045) and KCPM (ß = - 0.094, P = 0.016).

Conclusion Parental dental anxiety and knowledge of caries preventive measures are associated with the oral health of their children.

KEYWORDS Dental anxiety; Early Childhood Caries; Psychological profile.

Introduction

The term anxiety is defined as a reaction to potential stress [Barlow, 2002]. In the dental context, anxiety describes the response to thinking about how something bad could happen during dental treatment [Seligman et al., 2017]. Dental fear and dental anxiety are terms that are often used interchangeably, but dental fear is the reaction to immediate danger in a dental office [Seligman et al., 2017]. It is almost impossible to separate these two terms because patients often experience different combinations of dental anxiety and dental fear in everyday practice. Therefore, the term 'dental fear and anxiety' (DFA) is commonly used to describe the negative feelings related to the circumstances in dentistry [Klingberg and Broberg, 2007].

The etiology of DFA is multifactorial; factors that lead to its development can be divided into exogenous and endogenous factors [Klingberg and Broberg, 2007; Rachman, 1977]. Exogenous factors are based on three different modes of learning: direct conditioning (where anxiety develops as a result of the previous negative experience), indirect learning (as a result of observing the anxious behaviour of another person), and exposure to negative information, which is most often obtained from parents, family members, peers, teachers, television, or social media [Themessl-Huber et al., 2010]. Compared to the other two modes, direct conditioning has a more significant effect on the development of DFA [Rachman, 1977]. However, some patients develop anxiety even when they have not been previously exposed to any negative experience or information. In such patients, endogenous factors, such as genetic vulnerability, personality traits, age, and gender are considered to increase individual susceptibility to DFA [Bernson et al., 2013].

Numerous studies have shown a positive correlation between parents and children when it comes to the occurrence of DFA [Themessl-Huber et al., 2010; Armfield and Jason, 2010].

Dental anxiety may be indicated when the patient is still in the waiting room with specific patterns of behaviour, such as restless movements of the hands and feet, sweating, frequently changing seating positions, and the immediate reaction to noises. However, observing the patient's behaviour should not be used as an objective method for diagnosing dental anxiety [Rachman, 1977].

Several valid psychometric questionnaires can be used to evaluate dental anxiety: the Dental Anxiety Scale, the Index of Dental Anxiety and Fear for adults, or the Modified Child Dental Anxiety Scale for children [Armfield and Jason, 2010].

Through the process of primary socialisation, children learn and adopt attitudes about health, oral health and behaviour from their parents [Keel, 2016]. Parents are responsible for maintaining their children's oral health and hence, knowledge of parents' preventive actions is particularly important for the health of children [de Lima et al., 2014]. In addition, parents' psychological status, behaviour, and attitudes, can affect a child's general and oral health [Costa et al., 2017]. There are

studies which followed the concern and anxiety of parents of children with chronic illnesses. Dental caries is also a chronic infectious disease, mostly caused by Streptococcus mutans (S. mutans). Moreover, it is the most common chronic disease in children [AAPD, 2017]. When a child younger than 71 months (six years) has at least one carious (non-cavitated or cavitated) lesion in the primary teeth it is called early childhood caries (ECC) [AAPD, 2017]. This research explored whether the dental anxiety of the parents is associated with the oral health of their children.

Therefore, this study aimed to determine the level of dental anxiety of the parents of children younger than six years and whether there are differences in dental anxiety and the parents' level of knowledge of caries preventive measures regarding the prevalence of caries in children. Furthermore, whether parental dental anxiety is related to their psychological profile or demographic factors were determined.

The null hypothesis was that the presence of active caries in children and parental psychological profiles have no association with the parental dental anxiety level and parents' level of knowledge of caries preventive measures.

Methods

This case-control study involved children and their parents attending the Dental Clinic of Paediatric Dentistry, Study of Dental Medicine, School of Medicine, University of Split, Croatia for the first visit during the period from December 2018 to December 2019, and satisfied the inclusion criteria for control or case group.

Inclusion criteria for the control group was children under 6 years of age, without any active caries lesion in the primary teeth. Exclusion criteria for the control group were special health needs children, children with any caries lesions and children who had any orofacial pain or dental trauma experience.

The inclusion criteria for the case group were children with ECC, with one or more active caries lesions. Exclusion criteria were, as in the control group, special health needs and those in need of emergency treatment. All parents involved in the study were acquainted in detail with its purpose and, prior to completing the questionnaire, signed a written consent to participate in the research.

The study was approved by the Clinical Research Ethics Board of the School of Medicine of the University of Split and it was conducted in full accordance with the World Medical Association Declaration of Helsinki.

Sample size calculation for the study was conducted with a confidence level of 95% and test power of 80%. According to the sample's medians and standard deviations for tested variables S-DAI and KCPM considering the presence of active caries, the minimum sample size was 95 per group, respectively.

To avoid subjectivity, two specialists in paediatric dentistry conducted an oral examination of each child. First, the teeth were carefully cleaned with a rotating brush and a pumice/water slurry. After which, visual inspection was performed under adequate illumination, using a Plane Dental Mirror 22 mm (Carl Martin, Solngen, Germany) and Probe Sensitive (Carl Martin, Solngen, Germany). Caries detection and classification were based on the International Caries Detection and Assessment System (ICDAS), according to which the code 0 was considered as a caries-free tooth surface, while codes from 1 to 6 were considered as a tooth surface with a carious lesion [Ismail et al., 2007]. The scores from both examiners were compared, and the intraclass correlation coefficient was 0.96, which indicates excellent agreement and consistency between examiners. In case of disagreement, additional examination criteria were conducted until absolute consistency was achieved [Aartman, 1998]. After inter-examiner agreement, the number of teeth with active caries, the number of teeth with fillings, and the number of extracted teeth were recorded in the World Health Organization Oral Health Assessment Form for Children, 2013 [Petersen et al., 2013]. The dmft index was calculated for each child.

After the oral statuses of the children were recorded, the parents completed, in the dental office, the Short Version of the Dental Anxiety Inventory (S-DAI), Depression Anxiety Stress Scales (DASS), and Knowledge of Caries Preventive Measures (KCPM) questionnaires.

The S-DAI questionnaire has been used for many years as a valid and reliable instrument for measuring dental anxiety. The test contained nine items with answers on a 5-point Likert scale from 1 (not at all) to 5 (very much) and was derived from an extended version of the Dental Anxiety Inventory [Aartman, 1998]. The S-DAI was applied to the Croatian population by Majstorovic et al. in 2003 and showed validity in the Croat population [Majstorovic et al.,2003]. The level of dental anxiety is determined by a score from 9 to 45 obtained in the test. A score of less than 12 points represents a low score, 12–33 points indicates a mild score, and a score higher than 33 depicts a high level of dental anxiety [Aartman, 1998; Majstorovic et al.,2003].

The DASS questionnaire measures negative emotional states of depression, anxiety and stress. The task of the participant is to indicate how much each of the 42 affirmations relates to him/her on the four-point Likert scale: 0 (not applicable to me), 1 (somewhat applicable to me), 2 (mostly applicable to me) and 3 (fully applicable to me). The DASS instrument was invented in 1995 and has previously shown validity in the Croat population [Lovibond and Lovibond, 1995; Gavic et al., 2018].

In addition, the parents filled out a KCPM Questionnaire, a Croatian translation of the questionnaire from the study by Foloyan et al. [Foloyan et al., 2016]. They provided their opinion on eight statements on the 5-point Likert type scale from 1 (I completely disagree) to 5 (I completely agree). Cronbach's alpha coefficient of internal consistency for this questionnaire translated into Croatian was 0.722, which implied very good reliability [DeVellis, 1991]. The mean score of each respondent was determined. The median of mean scores was a cut-off point; the respondents with a higher score represent those with good knowledge. In contrast, the respondents with lower scores represent those with poor knowledge [Foloyan et al., 2016].

For statistical analysis of the data, the software package SPSS (IBM Corp., Armonk, New York) was used.The method of descriptive statistics was employed to determine the basic statistical parameters, and description of the population.

The predictors variables in the study were the score reached in the S-DAI test and the KCPM questionnaire, while the outcome variables were untreated caries lesions and parental psychological status (depression, anxiety and stress level). The parental age, employment status and education level were confounding variables.

The age of the participants, and dental status were the continuous variables. Parental employment status and gender were presented as the categorical variables. Parental education level, and their level of depression, anxiety and stress, as the outcome variables (S-DAI score, and KCPM score) were given as the ordinal variables.

	Number of active caries	N	S-DAI	P	Knowledge of caries preventive measures	P
Control Group	0	98	20.04±9.44	0.234	25.52±5.45	0.297
Study Group	≥1	155	21.03±9.43		25.07±6.68	
*(Mann-Whitney U test; * P< 0.05)*						

TABLE 1 The results of the parental mean values of S-DAI and the knowledge of caries preventive measures considering the presence of active caries in their children.

The distribution of outcome variables was tested with the Kolmogorov-Smirnov test.

The differences in S-DAI and preventive procedures knowledge scores between the parents of children with active caries and the parents of children who did not have active caries were established by the Mann-Whitney U test. Also, the differences between the number of active caries, dental fillings and extracted teeth in children according to the parental dental anxiety level were established by the Kruskal-Wallis test. The Kendall rank correlation was used to determine the association between variables.

The relationship between the child dental status, and parental psychological status as the outcome variables, and parental scores reached in the S-DAI test and KCPM questionnaire, employment status, education level and age as predictor associated factors were determined with a multiple linear regression analysis. The results were expressed in Pareto diagrams. The level of significance was set at 0.05.

Results

A total of 253 children (127 boys and 126 girls) of less than 72 months (6 years) of age and one respective parent participated in this study. The control group comprised the 98 parents whose child was caries free, while the study group comprised 155 parents whose children had one or more active caries lesions.

The age of the parents in the control group was from 24 to 41 years (mean age 33.73 ± 4.16), and in the study group the range was from 24 to 47 years (mean age 35.96 ± 5.01). The age of the children in the control group was from 0.5 to 6 years (mean age 3.96 ± 1.58), and in the study group it was from 2 to 6 years (mean age of 5.05 ± 1.05). Out of the total number of parents who accompanied their children to the dentist and who completed the questionnaires, 92.10% were mothers, 90 in the control group, and 143 in the study group. There was no significant difference in parents' age (P = 0.062) and employment status (P = 0.784) between the study and control group. But, a significant difference in parents' education level was observed between the study and control group (P=0.001).

Table 1 lists the mean scores of S-DAI and parents' level of knowledge of caries preventive measures by parents in the control group and in the study group. According to the Mann-Whitney U test, there is no significant difference observed neither for S-DAI (P=0.234), nor for the level of knowledge of caries preventive measures (P=0.297) between the groups.

The decayed, missing and filled primary teeth (dmft) index of the children ranged from 0 to 20 with a mean of 4.00 ± 4.27 (0.82 ±1.76 in the control group, and 6.00 ±4.17 in the study group).

According to the Kolmogorov-Smirnov test, the variables were not normally distributed (P<0.05). The Mann-Whitney U test did not show any statistically significant difference in the S-DAI test or KCPM of parents regardless of whether their children had active caries or not.

Table 2 shows the data obtained using the Kendall rank correlation analysis in order to analyse the association between the results of the S DAI test, Knowledge of Caries Preventive Measures and the parental level of depression, anxiety, and stress and the socio-demographic factors. The S-DAI score correlates slightly positively with the general anxiety level (ß = 0.122; P = 0.007), and slightly negatively with the stress level (ß = - 0.091; P = 0.040). Also, the S-DAI correlates negatively with the employment status (ß = - 0.266; P ≤ 0.001). There is no statistically significant correlation between the S-DAI score and the child dental status, as well as between the parental education level and the age. The Knowledge of Caries Preventive Measures slightly positively, but statistically significantly, correlates with the general anxiety (ß = 0.131; P = 0.004), depression (ß = 0.151; P = 0.002), and slightly negatively with the education level (ß = - 0.154; P = 0.002), and the active caries in children (ß = 0.119; P = 0.011). There is no statistically significant correlation between the Knowledge of Caries Preventive Measures number of filled or missing teeth in children, as well as the parental employment status and the age. Furthermore, there is no significant correlation between the S-DAI and the KCPM.

Table 3 shows the oral health status of the children considering the level of dental anxiety in parents. The Kruskal-Wallis test showed a statistically significant difference in the number of extracted teeth in children between the parental low and mild dental anxiety levels (P = 0.024). However, no significant difference is observed in the number of active caries and filled teeth in children according to parental dental anxiety level.

Figure 1 shows the results of the multiple linear regression analysis, in order to confirm the results expressed in Table 2, the association of the child dental status and parental scores in S-DAI, KCPM questionnaire, and parental psychological status and demographic factors.

The number of active caries in children was statistically significantly affected by parental age (ß = 0.156; P = 0.002), education level (ß = - 0.742; P = 0.014), employment status (ß = - 1.410; P = 0.028), dental anxiety level (ß = - 0.048; P = 0.045) and KCPM (ß = - 0.094; P = 0.016). The number of fillings in children was statistically significantly affected by parental education level (ß = - 0.662; P < 0.001), employment status (ß = 0.786; P = 0.011), and KCPM (ß = - 0.054; P = 0.004). The number of extracted primary teeth was affected by parental education level (ß = - 0.079; P = 0.003). The level of parental general anxiety was significantly affected by dental anxiety (ß = 0.093; P < 0.001). The level of parental stress was significantly affected by dental anxiety (ß = 0.101; P = 0.001), and parental age (ß = 0.163; P = 0.007). In addition, the level of parental depression was affected by parental age (ß = 0.084; P = 0.011), dental anxiety level (ß = 0.047; P = 0.003) and knowledge of caries preventive measures (ß = 0.067; P = 0.0012).

Discussion

To the best of our knowledge, this is the first study to assess the association between child dental status with parental dental anxiety, knowledge of caries preventive measures and psychological profiles.

The null hypothesis of the study was accepted. Namely, there is no significant difference observed for S-DAI and KCPM scores between the study and control groups (Table 1). In this research, the study group was composed of parents whose children have active caries lesions. But, it is important to emphasize that the study group was not consistent in the number of active caries

	Parental dental anxiety level	Parental depression level	Parental general anxiety level	Parental stress level	Parental education level	Number of active caries in children	Number of dental fillings in children	Number of extracted teeth in children	Parental knowledge of caries preventive measures	Parental age	Employment status
Parental dental anxiety level	1.000	ß = 0.091 P=0.055	ß = 0.122* P = 0.007	ß = 0.091* P = 0.040	ß = -0.063 P = 0.205	ß = 0.005 P = 0.921	ß = 0.005 P = 0.911	ß = - 0.079 P = 0.133	ß = 0.032 P=0.462	ß = - 0.070 P=0.113	ß = - 0.266* P = 0.001
Parental depression level	ß = 0.091 P=0.055	1.000	ß = 0.546* P = 0.000	ß = 0.494** P = 0.000	ß = 0.015 P = 0.778	ß = 0.133* P = 0.008	ß = 0.030 P = 0.569	ß = 0.093 P = 0.098	ß = 0.151* P = 0.002	ß = 0.130** P = 0.007	ß = - 0.079 P = 0.162
Parental general anxiety level	ß = 0.122* P = 0.007	ß = 0.546* P = 0.000	1.000	ß = 0.515* P = 0.001	ß = - 0.047 P = 0.363	ß = 0.074 P = 0.125	ß = 0.051 P = 0.309	ß = 0.184* P = 0.001	ß = 0.131* P = 0.004	ß = 0.016 P = 0.732	ß = - 0.044 P = 0.421
Parental stress level	ß = 0.091* P = 0.040	ß = 0.494* P = 0.001	ß = 0.515* P = 0.001	1.000	ß = 0.021 P=0.681	ß = 0.065 P = 0.169	ß = 0.048 P = 0.327	ß = 0.112 P = 0.035	ß = 0.072 P = 0.106	ß = 0.125* P = 0.006	ß = - 0.030 P = 0.574
Parental education level	ß = - 0.063 P = 0.205	ß = 0.015 P = 0.778	ß = - 0.047 P = 0.363	ß = 0.021 P = 0.681	1.000	ß = - 0.238** P=0.000	ß= - 0.160* P=0.003	ß = - 0.140* P = 0.018	ß = - 0.154* P = 0.002	ß = - 0.067 P = 0.183	ß = 0.167* P = 0.005
Number of active caries in children	ß = 0.005 P=0.921	ß = 0.133* P = 0.008	ß = 0.074 P=0.125	ß = 0.065 P=0.169	ß = - 0.238* P = 0.001	1.000	ß = 0.161* P = 0.002	ß = - 0.066 P = 0.233	ß = - 0.119* P = 0.011	ß = 0.154* P = 0.001	ß = - 0.052 P = 0.350
Number of dental fillings in children	ß = 0.005 P = 0.911	ß = 0.030 P = 0.569	ß = 0.051 P = 0.309	ß = 0.048 P = 0.327	ß = - 0.160* P = 0.003	ß = 0.161* P = 0.002	1.000	ß = 0.126* P = 0.029	ß = - 0.069 P = 0.153	ß = 0.083 P = 0.088	ß = 0.089 P = 0.122
Number of extracted teeth in children	ß = - 0.079 P = 0.133	ß = 0.093 P = 0.098	ß = 0.184* P = 0.001	ß = 0.112* P = 0.035	ß = - 0.140* P = 0.018	ß = - 0.066 P = 0.233	ß = 0.126* P = 0.029	1.000	ß = 0.049 P = 0.355	ß = 0.031 P = 0.553	ß = 0.057 P = 0.362
Parental knowledge of caries preventive measures	ß = 0.032 P = 0.462	ß = 0.151* P = 0.002	ß = 0.131* P = 0.004	ß = 0.072 P=0.106	ß = - 0.154* P=0.002	ß = 0.119* P = 0.011	ß = - 0.069 P = 0.153	ß = 0.049 P=0.355	1.000	ß = 0.078 P = 0.081	ß = 0.001 P = 0.988
Parental age	ß = - 0.070 P = 0.113	ß = 0.130* P = 0.007	ß = 0.016 P = 0.732	ß = 0.125* P = 0.006	ß = - 0.067 P = 0.183	ß = 0.154** P=0.001	ß = 0.083 P = 0.088	ß = 0.031 P = 0.553	ß = 0.078 P = 0.081	1.000	ß = 0.118* P = 0.027
Employment status	ß = - 0.266* P = 0.001	ß = - 0.079 P = 0.162	ß = - 0.044 P = 0.421	ß = - 0.030 P = 0.574	ß = 0.167* P = 0.005	ß = - 0.052 P = 0.350	ß = 0.089 P = 0.122	ß = 0.057 P = 0.362	ß = 0.001 P = 0.988	ß = 0.118* P = 0.027	1.000

TABLE 2 Association between the results of the S DAI test and the parental level of depression, anxiety, and stress and the socio-demographic factors (Kendall rank correlation analysis; $P < 0.05$).

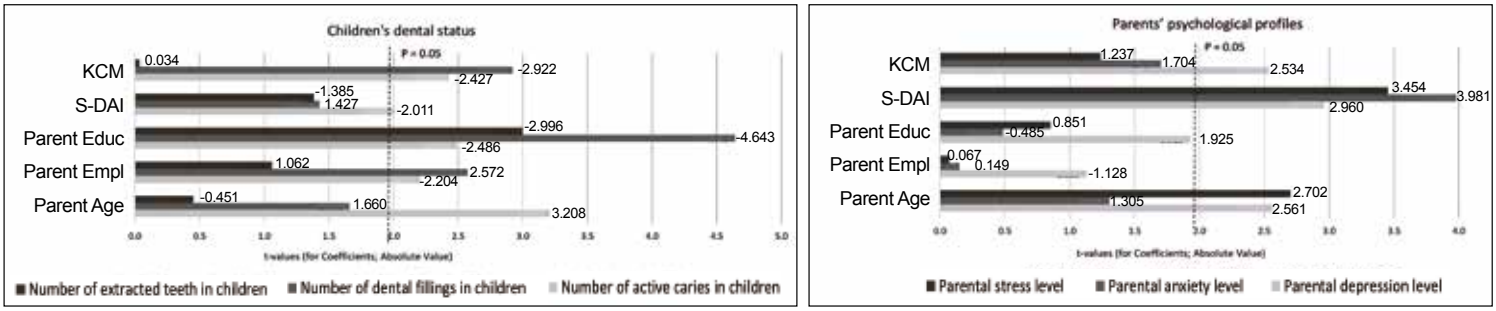

FIG. 1 Multiple linear regression analysis. The association of the child dental status and parental scores in S-DAI, KCPM questionnaire, and parental psychological status and demographic factors.

	Active caries in children	Dental fillings in children	Extracted teeth in children	dmft index in children
Parental low dental anxiety level (S-DAI≤11) N=67	2.42±3.09	1.37±1.69	0.18±0.49*	3.92±3.47
Parental mild dental anxiety level (S-DAI 12-33) N=143	2.72±4.41	1.23±1.93	0.06±0.23*	4.00±4.82
Parental high dental anxiety level (S-DAI >33) N=43	2.53±2.61	1.51±1.67	0.05±0.21	4.09±3.40

TABLE 3 The oral health status of the children considering the level of dental anxiety in parents (Kruskal-Wallis test; *P=0.026).

in children. Namely, 28.39 % of children had only one caries lesion. Other children had two (16.12 %), three (11.60 %), four (7.10 %), five (9.67 %), six (9.03 %), seven (3.23 %), eight (7.10%), ten (1.94 %), 13 (1.94%), 19 (1.94 %) or even 20 (1.94 %) active caries lesions. Consequently, further tests were necessary to examine the association of the number of active caries and entire dental status with S-DAI and KCPM. So, in addition, Kendall rank correlation analysis shows that dental status, specific to the number of active caries in children, is associated with KCPM (Table 2).

According to the multiple regression analysis results, there is an association between the dental status of the child and parental dental anxiety and knowledge of preventive procedures (Fig. 1). As expected, the parental level of depression, anxiety, and stress is associated with dental anxiety. Also, the level of parental depression is associated with parental knowledge of caries preventive measures.

In this study, the sample was almost completely comprised of mothers, which was to be expected because mothers more often accompany their children to the dental office than fathers. This agrees with other similar studies showing that mothers accompanied children to dental offices more than fathers [Virdee, 2007]. The reason maybe that mothers are the primary carers of young children and therefore are protective of them [Virdee, 2007]. Hence, it is expected that the mother accompanied children to the dental office rather than the father. In that way, the mother would be the carer that is likely to learn about preventive procedures, oral hygiene guidelines, and proper nutrition habits to prevent caries in their children [AAPD, 2017].

The S-DAI results were slightly positively associated with general anxiety (Table 2). These findings are opposite to those obtained in the study by Fuentes et al., where the authors did not find that general anxiety presents a predisposition to dental anxiety [Fuentes et al., 2009]. However, our results are in accordance with the study by Klages et al. [2006] where patients with increased levels of stress and anxiety tend to overstate the pain sensations at a time when the situation is perceived as potentially threatening. Accordingly, these patients have greater tendency to develop dental anxiety because they probably experience a higher level of pain during the dental treatment than patients with lower levels of stress and anxiety. Considering the systematic review by Halonen et al. [2018], the most common finding was a strong association of dental anxiety with anxiety disorders.

In addition, the results of the Kendall rank correlation analysis indicate that parental dental anxiety are negatively associated with the employment status (Table 2), which coincides with the results of other studies that found that the subjects who were unemployed had a higher score on the anxiety scale [Halonen et al., 2018]. Appukuttan et al. [2015] considered that the main reason for this is because employed people may be able to rationalize the situation better and cope better with it. In our study, the number of teeth with active caries and extracted teeth in the children depended negatively on the parents' S-DAI score (Fig. 1). These findings contrast with those obtained in the study by Goettems et al. [2012], where untreated active caries in children were associated with a higher level of dental anxiety in mothers. Additionally, the study by Khawja et al. [2015] shows a significant association between a mother's anxiety and increased caries findings in the oral cavity of the child. Our results have shown the opposite and may be explained by the fact that parents who developed anxiety were keen to prevent caries development in their children and, thus, more attention is paid to the oral hygiene of the child. Additionally, we noticed that those parents who have a higher dental anxiety more often bring their children into the dental office (ß = 0.257; P = 0.001); therefore, the number of teeth with caries or extracted teeth in these children could be lower.

According to the results of the Kendall rank correlation analysis, in this study, no association of the parental education level and the dental anxiety was observed (Table 2). These results are opposite to those obtained by Erten et al., where a higher level of dental anxiety occurred in patients with higher levels of education. Consequently, they develop an awareness of oral hygiene and the importance of frequent check-ups, which eventually results in reducing dental anxiety [Erten et al., 2006].

In this study, a correlation between the S-DAI score and the knowledge score has not been established. The score from the Preventive Procedures Knowledge Questionnaire was from 14 to 39, while the median score was 25, and the mean score was 25.84. Of the total number of respondents, 143 (56.52%) had a score equal or higher than 25, and 110 (43.48%) had a score lower than 25. These results indicate that a high number of respondents have insufficient knowledge of caries preventive measures.

The result of the Kendall rank correlation analysis has shown the slightly negative association between parental KCPM and their educational level (Table 2). Despite this, the Kendall rank correlation analysis has shown the slightly negative association between level of parental education and number of active caries, extracted teeth or teeth with fillings in children (Table 2). Also, the multiple linear regression analysis, showed that number of extracted teeth or teeth with fillings in children depends on parental education level (Fig. 1). This corresponds to other studies; Rajab et al. [2002] concluded that higher educated parents pay more attention to their children's oral health.

The phenomenon of dental anxiety indicates the need for a timely diagnosis, prevention at an early age, and adjustment of the treatment of these patients. Suppressing dental anxiety in parents in time can prevent further possible transmission to the child. The presence of dental anxiety in parents, especially mothers, is associated with anxiety being reflected in their children [Ain et al., 2016].

All respondents completed the questionnaire in the dental clinic, which also may be viewed as a limitation of the study. Namely, that means that the parents accompanied the children in the dental clinic for some reason, so the results could be

different if the parents completed the questionnaire elsewhere. The American Dental Association, American Academy of Paediatric Dentistry, and Croatian Dental Chamber recommend that a child's first visit should be when the first tooth erupts in the mouth, no later than the age of one to two years old [AAPD, 2017]. The aim of the early child appointment is precisely because of the adjustment of the child to the "dental environment" and for dental anxiety prevention. In this way, younger patients cooperate with regular check-ups and preventive procedures, and caries at that age could be reduced. The source of anxiety can be a fear of choking, fear of injection, aversion to bleeding, low tolerance to pain, or mistrust in the clinician [Seligman et al., 2017; Klingberg and Broberg, 2007]. It is extremely important that the members of the dental team have a clear understanding of why patients experience dental anxiety and how it affects their thoughts, feelings and behaviour. In such circumstances, good communication skills and established relationships with patients are crucial [Armfield and Jason, 2010]. This will allow clinicians to develop empathy towards their patients, which is the first step in the development of an adequate treatment plan, resulting in better oral health for both parents and their children.

Conclusions

- Parental dental anxiety and caries preventive measures knowledge are associated with the oral health of their children.
- It is crucial to understand how the parental dental anxiety affects the oral health in children.
- Dental anxiety in parents is associated with the development of dental anxiety in children: the detailed understanding of the development of dental anxiety in parents could help the prevention of the same in children.

Author contributions

Each author has significant intellectual contribution to the work. A.M. and K.G. helped in samples collecting and manuscript preparation. A.T. contributed to the conception and design of the study but also in interpretation of the results and manuscript preparation. S.S contributed in manuscript preparation and revision in English language. L.G. is main researcher and corresponding author, performed the statistical analysis and helped in interpretation of the results. The manuscript has been read and approved by all authors in its submitted form.

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Conflict of interest

The authors declare no conflict of interest.

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