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Background factors associated with endodontic treatment due to caries in young permanent teeth

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Abstract

Objective. The aim of this retrospective cohort study was to assess the association between background factors and future endodontic treatment due to caries in young permanent teeth. ***Material and methods.*** The material comprised all 19-year-olds born in 1979 in a city in Sweden who had experienced endodontic treatment due to caries in permanent teeth ($n = 105$) and a control group with no endodontic treatment. From dental records, the following independent variables were derived from age 7 to age 19: immigrant background, caries prevalence (DMFT values) at age 10, occurrence of dental anxiety, and missed or cancelled appointments before endodontic treatment. The outcome variable was presence or absence of endodontic treatment due to caries. Bivariate analysis and a multiple logistic regression model were used to analyse the data. ***Results.*** In the bivariate analyses, all independent variables except cancelled appointments were statistically significantly associated with future endodontic treatment. Of these, immigrant background did not remain as a statistically significant factor in the multiple regression model. The highest odds ratios were 4.3 for >2 DMFT at age 10 and 4.1 for >20% missed appointments. ***Conclusion.*** In the present sample, with a relatively high proportion of individuals with an immigrant background, >2 DMFT at age 10, many missed appointments and dental anxiety were all risk indicators for future endodontic treatment due to caries up to age 19.

Key Words: *Dental anxiety, dental avoidance, dental caries, immigrants, risk assessment*

Introduction

A majority of the children and adolescents in contemporary populations have little experience of cavitated caries. However, uneven distributions of decayed, missing, and filled surfaces or teeth show that a minority still suffer from severe caries [1], and for some of these individuals a deep caries lesion may result in endodontic treatment.

Studies reporting on the prevalence of endodontic treatment in young permanent teeth are in short supply. In a North American study [2], the prevalence of endodontically treated teeth in individuals under the age of 20 was 0.5% and Hugoson et al. [3] found a prevalence of 0.2% in Swedish 20-year-olds. Neither of these studies reported the prevalence on an individual basis. In another Swedish population that had a high proportion with an immigrant background (33% according to official statistics), 9% of 19-year-olds had one or more endodontically treated teeth [4]. Immigrant background was defined as either born abroad or born in Sweden with both parents born abroad. In the latter study, caries was the reason for endodontic treatment in a majority of cases. The quality of these root fillings was inadequate in about half of the teeth and the prevalence of apical periodontitis was the same regardless of whether endodontic treatment was motivated by caries, by traumatic injury, or by developmental disturbance [5].

Considering that the dental health service in Sweden is organized, regular, and free of charge up to the age of 19, it is remarkable that as many as 9% of 19-year-olds have at least one endodontically treated tooth [4]. Factors such as immigrant background, dental anxiety, and avoidance of dental treatment have been found to be associated with poor oral health in adolescents [6–9], but it is not known whether these are also associated with endodontic treatment due to caries. It was therefore considered of interest to investigate whether background factors (hereafter called risk indicators) known to be associated with high caries risk are

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also associated with future endodontic treatment up to age 19.

The aim, therefore, was to analyse whether risk indicators such as immigrant background, high caries experience in permanent teeth at an early age, dental anxiety, and cancelled or missed appointments were associated with future endodontic treatment due to caries. The null hypothesis was that no statistically significant association existed between the risk indicators and future endodontic treatment up to age 19.

Material and methods

Sample

The sample originated from a retrospective cohort study on the prevalence of endodontic treatment in adolescents and young adults [4]. Conducted in 1999, that study included all individuals born in 1979 and belonging to the reception area of all public dental clinics ($n=20$) in Malmö, a city of almost 300,000 inhabitants. The prevalence of individuals with at least one endodontically treated tooth was 9% (173/1971). About 20% of the individuals had their endodontic treatment performed between 10 and 13 years of age (mean $=16.2$ years).

Initially, the present sample consisted of all individuals from the original sample who had had endodontic treatment due to caries ($n=126$) and a control group without endodontic treatment. Individuals in the control group were of the same age and gender and registered at the same clinic as those with endodontic treatment. Of the 126 individuals, 21 were excluded because the endodontic treatment had been performed elsewhere. The final sample thus consisted of 105 individuals (54% female, 46% male) in each group. The study was approved by the Regional Ethics Review Board of Lund University.

Data collection

Data were collected from patient records for the age range 7 to 19 (usually yearly check-ups) and included information about type of tooth and reason for endodontic treatment, immigrant background, caries experience (DMFT) at ages 10, 16, and 19, any presence of dental anxiety, and missed or cancelled dental appointments. To be able to analyse whether any dental anxiety and missed or cancelled dental appointments had preceded or occurred after the start of endodontic treatment, the dates of these events were registered.

In regard to immigrant background, information about any foreign country of birth was derived from the patient records. The individuals originated from 21 countries (the majority from Macedonia, Kosovo, Bosnia and Herzegovina, Romania and Bulgaria). If the record contained no information about this, the family name (Nordic or not) was used to determine immigrant background. Dental anxiety was said to be present if dental anxiety or treatment difficulties were noted in the record on at least two different appointments between ages 7 and 19. Missed dental appointments were expressed as a percentage and calculated as the number of missed appointments divided by all appointments from age 7 to age 19. Cancelled dental appointments were calculated correspondingly. The independent variables immigrant background, caries prevalence at age 10, dental anxiety and missed and cancelled appointments were dichotomized. Definitions of the categories and the number of individuals in each category are given in Table I. Table II gives the number and distribution of individuals with endodontic treatment according to tooth type. The mean DMFT at ages 10, 16, and 19 for the endodontically treated group and the control group are given in Table III.

Data analysis

Since the aim was to assess whether dental anxiety and missed or cancelled dental appointments, respectively, were associated with future endodontic treatment, the occurrence of each of these items was decomposed into those occurring before as opposed to after the start of endodontic treatment. Thus, in the analysis, only individuals in whom dental anxiety occurred before the start of endodontic treatment were considered to have dental anxiety. The same applied in the case of missed or cancelled appointments.

A relatively large proportion of DMFT at age 10 were missing (Table I). To evaluate whether or

Table I. Independent variables and occurrence*. Individuals with endodontic treatment (=endo), no endodontic treatment (=control)

	Occurrence		
Variable	Endo	Control	Total
Immigrant background			
No	32	60	92
Yes	73	45	118
DMFT age 10			
≤2	21	67	88
>2	31	18	49
Dental anxiety			
No	84	100	184
Yes	17	5	22
Missed appointments			
≤20%	66	91	157
>20%	35	14	49
Cancelled appointments			
≤10%	84	83	167
>10%	21	22	43

*Totals differ due to missing data for some variables (total $n=210$).

Table II. Distribution of individuals by type of tooth with endodontic treatment because of caries

Type of tooth	No. of individuals			Total (tooth type)
	1 tooth*	2 teeth**	≥3 teeth***	
1st molar	58	13	5	76
2nd molar	10	3	1	14
Premolar	15	7	5	27
Incisor/bicuspid	22	5	7	34
Total	105	28	18	151

*Individuals with 1 endodontically treated tooth.
**Individuals with 2 endodontically treated teeth.
***Individuals with 3 or more endodontically treated teeth.

not missing observations on DMFT at age 10 differed from those that were available, DMFT at age 16 were compared between individuals with and without available DMFT values at age 10. The difference was statistically significant, that is, those with missing data at age 10 had more caries at age 16 than those with available data at age 10. This was the case in both groups, but most evidently in the endodontically treated group.

The Mann-Whitney test was used to assess differences between mean values (DMFT). The chi-squared test was used to test the relationship between an independent variable and the dependent variable presence or absence of endodontic treatment. The strength of relationships between the independent variables and the dependent was estimated in a logistic regression model with a likelihood ratio test. Possible interactions between independent variables were also tested. The level of significance was set at 0.05. The software used for analysing the data was SPSS, version 14.

Results

Caries prevalences at ages 10, 16, and 19 are given in Table III. The differences in caries prevalence between the two groups were statistically significant for all ages. Sixty percent of the endodontically treated teeth were molars (Table II) equally distributed between upper and lower teeth. The bivariate analyses showed a statistically significant association between individuals with and without endodontic treatment for all independent variables except cancelled appointments. The distributions of individuals in the two groups are given in Table I. At age 10, children from an immigrant background had significantly higher DMFT values than Swedish children (2.7 versus 1.2). In the multiple regression model, the three independent variables, i.e. caries prevalence (DMFT) at age 10, missed appointments, and dental anxiety, remained statistically significant (Table IV). The highest odds ratio, 4.3, was found for >2 DMFT at age 10, that is, a child with 3 or more DMFT at age 10 was 4.3 times more likely to have endodontic treatment than a child with <3 DMFT at age 10. Furthermore, an individual with many missed appointments ($>20\%$ of all appointments) was 4.1 times more likely to have endodontic treatment due to caries than an individual with fewer missed appointments. The null hypothesis was therefore rejected.

When tested separately, the variables, i.e. missed appointments and immigrant background, interacted, and, when combined, the effect of missed appointments was statistically significantly higher for individuals with immigrant background. However, this combined variable did not remain statistically significant when added to the multiple regression model. The same applied to DMFT at age 10 when combined with immigrant background.

Discussion

This individual-based study analysed risk indicators for future endodontic treatment during adolescence. The individuals who had experienced endodontic treatment and their controls represented the entire population of 19-year-olds living in a Swedish city in 1999.

Using retrospective information from patient records makes it difficult to control for missing data; a critical issue is whether missing observations are a

Table III. Mean (SD) decayed, missing, and filled permanent teeth (DMFT) at ages 10, 16, and 19 in the endodontically treated group (endo) and the control group (control)

Age (years)	DMFT (SD)				Significance (p-value)
	Endo	n	Control	n	
10	2.7 (1.90)	53	1.3 (1.75)	85	<0.001
16	9.5 (5.13)	93	3.5 (3.19)	97	<0.001
19	11.5 (4.98)	100	4.5 (3.70)	105	<0.001

Table IV. Estimated odds ratios of five independent variables based on a multiple logistic regression model. The dependent variable is endodontic treatment (CI = confidence interval)

Independent variable*	Odds ratio	95% CI	Significance p-value
DMFT, age 10 reference 0–2	4.3	1.87, 10.09	0.001
Missed appointments reference ≤20%**	4.1	1.82, 9.25	0.001
Dental anxiety reference no dental anxiety	3.7	1.14, 12.19	0.029
Immigrant background reference Nordic	1.3	0.61, 2.77	0.492
Cancelled appointments reference <11%***	1.0	0.43, 2.18	0.940

*In the bivariate analyses, all independent variables except cancelled appointments differed statistically significantly between individuals with and without endodontic treatment.
**Number of missed appointments divided by total number of appointments × 100.
***Number of cancelled appointments divided by total number of appointments × 100.

random phenomenon or are due to some causal factor. For caries prevalence at age 10, the proportion of missing data was relatively large (Table I). The analysis of missing data revealed a difference in DMFT at age 16 between those with and those without missing data on DMFT at age 10 for both the endodontically treated and the control group. However, the distribution of missing DMFT in the two groups showed that the inter-group difference in DMFT at age 10 was underestimated rather than overestimated. Another matter of concern was incomplete information about immigrant background. When data were missing on country of birth, the family name was used to define immigrant background. This may not be entirely relevant, since the individual could be a second-generation immigrant and thus perhaps relatively well integrated in Swedish society. Overall, the sample is small and the results must therefore be interpreted with caution.

Possible interactions between the independent variables and their effects on the outcome were assessed in the logistic regression model. The results indicated that none of them contributed to the power of the multiple model. This could have been due to the small numbers or to the single independent variables being more powerful than any interaction between them.

Presence of dental anxiety in the present control group of 5% was defined from notes in the records (Table I). Since any bias from overestimation or underestimation of dental anxiety would affect both groups, it is unlikely that the results were flawed. The reported prevalence of dental anxiety in Scandinavian teenagers varies between 3% and 19% [11,12]. The difference might be explained by different populations with different caries experience being investigated and/or by different methods used for assessing dental anxiety.

The number of missed and cancelled appointments is likely to be valid because the dental personnel need to establish why a patient does not turn up in order to justify their efforts. In the present study, 13.3% of the individuals in the control group missed >20% of their appointments (Table I). This is almost identical with the findings of Skaret et al. [10], who investigated attendance for dental treatment in a group of Norwegian teenagers, where 13.6% missed at least 20% of appointments.

In several studies, poor oral health in teenagers has been associated with immigrant background [7–9]. In the present study, poor oral health at age 10 (>2 DMFT) was the most important risk indicator for future endodontic treatment and was more common among children with an immigrant background. The second most important risk indicator was many missed appointments. Emphasis on yearly check-ups and preventive measures for this group is therefore important. Wislöff et al. [11] found that Norwegian recruits with a high level of dental anxiety had more oral problems and avoided dental treatment more often than a control group. This is in accordance with the present findings in the sense that dental anxiety was another significant risk indicator of future endodontic treatment. Being alert to the presence of dental anxiety and/or missed appointments, particularly when combined with poor dental health at age 10, is therefore crucial for preventing deep caries lesions and subsequent endodontic treatment.

It is important to realize, however, that the reasons why adolescents do not attend dental treatment are not straightforward. Thus, besides dental anxiety, it has been found that patients' subjective norms and attitudes are important for intention to visit the dentist [6,12–14]. As an example, besides dental anxiety, responders to a questionnaire explained their non-attendance by answering "because I didn't bother" [12]. These attitudes are difficult to change and may seriously hamper efforts to reach and treat the patient successfully.

It has to be appreciated that the alternative to endodontic treatment is extraction. The extent to which this alternative was chosen in the present population is not known. In general, preserving young permanent teeth is important and a difficult balance has to be struck between this and the more rational extraction therapy. However, from a practical and cost-effective point of view, and considering the high proportion of inadequate root fillings in young permanent teeth [5], extraction should be

considered as an alternative to endodontic treatment.

A majority of the endodontically treated teeth were 1st molars (Table II). The 1st molar is still considered to be the most caries-prone permanent tooth. Thus, the occlusal, mesial, and distal surfaces of 1st molars accounted for 60% of all restored surfaces at age 21 [15]. The present results suggest that this tooth is also prone to endodontic treatment due to caries. Preventive strategies, such as early fissure sealing in high caries-risk individuals and timely restorative treatment before a deep dentine lesion has developed, should therefore be emphasized. Proper diagnosis of dentine lesions is another aspect that has been highlighted [16,17]. The authors of these studies found that the dentist had overlooked a large proportion of occlusal surfaces of young permanent molars that had obvious dentine lesions as judged from bitewing radiographs. However, the extent to which such missed diagnoses may contribute to future endodontic treatment is not known.

In conclusion, in the present sample with a relatively high proportion of individuals with immigrant background, >2 DMFT at age 10, many missed appointments, and the presence of dental anxiety were all risk indicators for future endodontic treatment due to caries up to age 19.

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