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ANALYSIS OF BEHAVIOR AND COMMUNICATION DURING DENTAL APPOINTMENTS IN CHILDREN WITH ATTENTION AND LEARNING PROBLEMS

Licentiatavhandling

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av

My Blomqvist
Leg. tandläkare

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To Kenneth and my father

ABSTRACT

Attention and learning problems in children are common and have a substantial impact on many situations in the child's daily life. The present thesis investigates the prevalence of behavior management problems (BMP) and the characteristics of communication during dental appointments in a group of children with attention and learning problems compared to a control group. The thesis comprises a retrospective dental record study of BMP and a prospective, detailed video analysis of the behavior of a group of children during a dental recall visit.

The first aim was to investigate whether children with attention and learning problems had more dental behavior management problems (BMP), more cancelled and missed appointments, and more traumatic dental injuries compared with a control group. The second aim was to make a detailed analysis of behavioral interactions between the dentist and the child patient with attention and learning problems.

All children born in 1991 (n=555) in one Swedish municipality were screened for attention and learning problems with Conner's 10-item questionnaire and a questionnaire focused on executive and learning problems.

The dental records of 128 screen-positive index cases and 131 screen-negative control cases were studied from 1 year of age until the child turned 10. BMP on at least one occasion were more common in the index group than in the control group (54% vs. 37%). The percentage of appointments at which the children exhibited BMP was also higher in the index group (13% vs. 7%). No differences were found concerning cancelled or missed appointments or dental traumatic injuries between the two groups.

The dental recall visit at 11 years of age for 65 index cases and 60 control cases was recorded on video and analyzed. The interaction between the dentist and the child was scored as verbal and nonverbal initiatives and responses. Total examination time was significantly longer in the index group. The children in the index group took significantly more initiatives, had significantly fewer verbal responses, were less coordinated between verbal and nonverbal responses, and had more missing responses than the children in the control group.

In conclusion, the results of this thesis show that children with attention and learning problems had significantly more behavior management problems compared to a control group. The problems in communication observed in the children with attention and learning problems resulted in less two-way communication between the dentist and the child and

poorer timing compared to the interaction between the dentist and the children in the control group.

Key words
attention deficit, behavioral science, children, dental, learning problems

SAMMANFATTNING

Uppmärksamhets- och inlärningsproblem är vanligt förekommande hos barn i skolåldern. Dessa problem kan vara ett tecken på barnneuropsykiatriska funktionshinder, såsom ADHD eller ett tecken på att barnet har en lägre begåvning (IQ).

Denna avhandling studerar kooperationsproblem i tandvården samt kommunikationen, s.k. samspel, hos en grupp barn med uppmärksamhets och inlärningsproblem. Barnen jämförs med en kontrollgrupp med barn utan dylika problem. Avhandlingen innefattar dels en journalstudie och dels en klinisk studie av elva åriga barn.

Alla 555 barn födda år 1991 boende i en kommun norr om Stockholm år 2001 medverkade i studien. Barnen genomgick en undersökning för att utreda om de hade uppmärksamhets- eller inlärningsproblem.

Tanvårdsjournalerna för 128 barn med uppmärksamhets- eller inlärnings-problem och 131 barn utan dylika problem genomlästes med avseende att registrera kooperationsproblem i tandvården, uteblivande från och avbokande av tandläkarbesök samt antal tandskador. Jämfört med barnen i kontrollgruppen hade barnen med inlärnings- eller uppmärksamhetsproblem mer kooperationsproblem mellan två och tio års ålder. Dessa barn hade inte fler uteblivanden, avbokade besök eller tandskador.

Då barnen var 11 år gamla kallades 65 barn med uppmärksamhets- eller inlärningsproblem samt 60 barn utan dylika problem till en tandläkarundersökning som videofilmades. Ur videoinspelningarna analyserades barnens och tandläkarens kommunikation, s.k. samspel. Jämfört med barnen i kontrollgruppen tog undersökningen för barnen med uppmärksamhets- och inlärningsproblem längre tid. Dessa barn ställde fler frågor till tandläkaren och gav mer kommentarer. Svaren barnen gav var mer otydliga och barnen lät oftare bli att svara tandläkaren.

CONTENTS

PREFACE

This thesis is based on the following original papers, which will be referred to in the text by their Roman numerals (I, II):

I Blomqvist M, Holmberg K, Fernell E, Dahllöf G: A retrospective study of behavior management problems in children with attention and learning problems.
Eur J Oral Sci 2004; 112: 406-411.

II Blomqvist M, Augustsson M, Bertlin C, Holmberg K, Fernell E, Dahllöf G, Ek U: How do children with attention and learning problems interact in a clinical dental examination? A video analysis.
Eur J Oral Sci – submitted Oct 2004.

ABBREVIATIONS

ADHD	attention deficit hyperactivity disorder
ADHD-C	ADHD combined type (inattention and hyperactivity/impulsivity)
ADHD-HI	ADHD with mainly hyperactivity/impulsivity
ADHD-I	ADHD with mainly inattention
ASD	autism spectrum disorder
BMP	behavior management problems
CD	conduct disorder
DAMP	deficits in attention, motor control and perception
EF	executive function
EFSS	the executive function screening questionnaire
IE	interaction element
IQ	intelligence quotient
MPD	motor perception dysfunction
MR	mental retardation (IQ ≤ 70)
MMR	mild mental retardation (IQ 50-70, termed learning disabilities in the UK)
ODD	oppositional defiant disorder
PDS	public dental service

INTRODUCTION

Attention and learning problems

Attention and learning problems in children are common (1–4). These two areas often reflect developmental disorders and frequently coexist (2, 5–10). Developmental disorders/children's neuropsychiatric disorders are clinically significant behavioral problems and emotional disorders that lead to considerable handicap in the everyday life and that to a large extent can be explained by biological factors (11).

Different kinds of defined developmental disorders affect approximately 10% of a general child population (1). The most common are Attention Deficit Hyperactivity Disorder (ADHD), occurring in about 5%–10%, mental retardation (MR, IQ ≤ 70) in about 1%–2%, and autism spectrum disorders (ASD) in about 1% (1-3). In addition, children with borderline functioning within different developmental domains, such as children with milder degrees of attention-related problems or with intellectual functions in the low normal area (IQ 71-85), may also exhibit behavioral problems in demanding and unfamiliar situations. In such situations, the demands on the child's cognitive capacity may exceed the child's current ability.

Dental behavior management problems

In everyday life, all children encounter situations where there are certain demands for adaptation and interplay. One such situation can be exemplified by a dental visit. BMP in dentistry are commonly characterized as uncooperative and disruptive behaviors resulting in a delay of treatment or rendering treatment impossible (12). In a recent study by Wogelius et al. (13) on 6–8-year-old Danish children, a history of BMP, measured as a cumulative frequency, was observed in 37.2%. According to a Swedish study by Klingberg et al. (12), 10.5% of all children have BMP at least once between 4 and 6 and between 9 and 11 years of age. BMP was more common among the younger children (15.6 %) than the older (5.5 %). Among all the children, 27.3% reported a high level of dental fear, as defined by the dental subscale of the children's fear survey schedule (14), but for a large proportion of children who exhibited BMP during dental treatment, the causes were unknown. In a study on BMP in relation to child personality characteristics, Arnrup et al. (15) concluded that uncooperative child dental patients constitute a heterogeneous group regarding fear, temperament, behavior, and intelligence.

Holst and Crossner (16) investigated the occurrence of BMP from direct ratings of acceptance in 3–16-year-old patients during their annual regular dental care. The majority of children needed no more than one dental visit. Eight percent of the children reacted in such a way that treatment could not be carried out without restraint or undue delay.

Dental BMP in children with attention problems

According to a Dutch study, 15% of the children referred to a center for special dental care because of a high level of dental fear had an attention problem (17). In the study by Arnrup et al. (15), it was found that in addition to dental fear, a higher level of impulsivity most clearly discriminated uncooperative child dental patients from a reference group of children. The same authors identified four different fear and personality subgroups among child patients with BMP using cluster analysis (15). The children in the subgroup characterized as externalizing and impulsive, although undiagnosed at the start of the study, had a temperament and behavior profile similar to that of children diagnosed with oppositional defiant disorder (ODD) and conduct disorder (CD), in some cases further complicated by attention deficit problems, hyperactivity problems, or both. During the study period, some of the children in this subgroup were diagnosed with psychiatric disorders (e.g., ADHD). One possible inference from this was that specialized pediatric dentistry could serve as an aid in the early detection of children in need of further investigation and treatment for attentional and behavioral deviancies (18).

In a Brazilian study (19), a strong significant association was found between children's behavior (rated on the Frankl scale) during dental appointments and learning or behavior problems reported by the parents. Felicetti et al. (20) studied the behavior of children with ADHD in a clinical trial and measured cooperation according to the Frankl scale. No differences in behavior compared to a control group could be found.

Dental BMP in other developmental disorders

ASD—which is also a developmental disorder—and dentistry have been studied more thoroughly than other developmental disorders. The prevalence of caries in children with autism does not differ from that of non-handicapped children of the same age, but the capacity of autistic children to cooperate in the dental setting, however, is inadequate (21). The actual needs of the family and patients are not so much for dental treatment but for a gradual increase in familiarity with dental and preventive care (22). When a child with autism is under treatment, oral commands should be clear with short and simple sentences (23). It is easier for

the patient with autism to communicate via pictures than via words and visual pedagogy is therefore a way of introducing dentistry to such children (24).

Dental BMP in children with intellectual functions in the low normal area and in mental retardation

Intellectual functions in the low normal area and MR are associated with an increased risk of psychopathology (25). In children with mild mental retardation (MMR, IQ 50-70, termed learning disabilities in the UK) or with cognitive capacities in the lower normal range, behavioral problems such as hyperactivity and emotional and autistic symptoms are often present (26, 27). No studies have been done on children with intellectual functions in the low normal area regarding dental behavior. Rud and Kisling (28) studied the dental behavior of children with MR and concluded that children with an IQ < 68 needed a significantly longer time to adjust to and accept dental treatment. In a Spanish study (29), general intelligence was found to be more strongly associated with children's dental anxiety than were personality factors. In a review article, Winer (30) has suggested that both extremes of intelligence level, that is, high and low, may be related to high dental fear. In the study by Arnrup et al. (15), the group of children with BMP characterized as externalizing and impulsive had a lower verbal IQ than the other children with BMP.

Interaction as a measure of behavior

A more detailed way to study behavior is to study interaction between two persons. Interaction is a complex process that requires certain cognitive abilities such as adaptation, attention, and self-regulation, functions that are impaired in children with an attention deficit, autism spectrum disorders and in children with a general low cognitive function. These children run the risk of encountering problems in different demanding situations, such as a dental examination.

Video analysis has previously been used to study interaction between the dentist and the patient (31, 32), but the method has been limited due to its lack of detail. The marte meo therapy model can be used to study interaction between two persons in more detail (33). The interaction between a parent and a child is video recorded and then divided into short sections to help the parent observe the fine components of interaction and thereby identify the interaction problems. The same method could be used to study the interaction between the dentist and a patient during a dental examination.

Attention Deficit Hyperactivity Disorder

ADHD is the most common behavioral disorder in school-age children with prevalence rates varying from 2% to 20% (11, 34). However, diagnostic criteria for the disorder are fulfilled by 3%–7% of school-aged children (2, 35). This variation is due to several factors such as the definition applied, the characteristics of the study population, and the methods of ascertainment (4). Boys are diagnosed three to six times more often than girls (34). Recently it has been shown that girls with ADHD are underdiagnosed (3). This may, at least partly, be due to the girls less prominent hyperactivity and less observable difficulties.

ADHD is a clinical diagnosis that is given when a certain number of criteria are fulfilled concerning inattention, hyperactivity, and impulsivity (35). ADHD can be subdivided into three subtypes, depending on what symptom group is most represented: ADHD with mainly inattention (ADHD-I), ADHD with mainly hyperactivity/impulsivity (ADHD-HI), and ADHD combined type (ADHD-C), where both symptoms of inattention and hyperactivity/impulsivity are present. Thus, ADHD is a heterogeneous condition. Some children are hyperactive while others rather are hypoactive and passive.

DAMP (deficits in attention, motor control and perception) is a concept used mainly in Scandinavia and Finland to describe ADHD in a child who often also has a motor-perceptive dysfunction. DAMP can be described as a combination of ADHD and developmental coordination disorder (DCD) (35).

As children with attentional difficulties are followed over time, it has become clear that these problems can be quite persistent and associated with a range of difficulties in adulthood (36). In a Swedish longitudinal study on 7–22-year-olds, it was found that 58% in the ADHD/DCD group had a poor outcome compared with 13% in the comparison group meaning that they were living on a pension; suffered from drug or alcohol abuse; had a major personality disorder, a severe chronic psychiatric disorder, or an autism spectrum disorder; or had been convicted of crime (37). Antisocial personality disorder, reading disorders, low educational level and remaining symptoms of ADHD were overrepresented in the ADHD/DCD group.

The unifying abstraction that best encompasses the mechanism principally affected in attention problems has been termed executive functions (EFs).

Executive functions

There is empirical support for the importance of EFs in ADHD (38). According to Barkley (39), who studied ADHD specifically, poor behavioral inhibition is the central deficiency in

attention deficits. The inhibition deficit causes a secondary deficiency in the EF. EFs can be described as mental control processes that enable self-control and are necessary to maintain an appropriate problem-solving set for the attainment of a future goal (40). EF encompass four different cognitive domains: 1) nonverbal working memory (sensing the hypothetical future from the experienced past), 2) verbal working memory (self-reflection, self-instruction, and problem solving), 3) self-regulation of affect/motivation/arousal, and 4) reconstruction (fluency, flexibility, and analysis) (39). The EF domains depend on one another. EFs make it possible for an individual to adjust to a social situation; therefore the EFs become more important with increasing age (41).

The EFs permit the construction, execution, and control of behavior by internally represented information, which removes behavior from control in the present and brings it under the control of time. ADHD disrupts this process and returns control of behavior to the temporal now. A blindness to the past, the future, and time in general as well as an inability to direct behavior toward the future and to sustain it are among many of the deficits for persons with ADHD (42). Children with ADHD perform poorly on time reproduction tasks, which place heavy loads on impulsiveness and attentional processes (43).

Children with ADHD find it difficult to shift focus (44). According to Brown (45) inattention is a result of a deficiency to organize oneself at the prospect of a task, which leads to difficulties in concentrating and staying focused during the task. Individuals with ADHD lose their focus on what they are doing when other things surrounding them becomes as important because the energy needed to repress the distracting stimuli cannot be mobilized. Thus, these highly important functions will be of considerable importance in several everyday activities and it can be assumed that deficits in this cognitive domain will influence a child's behavior and coping in a clinical setting, such as a dental examination.

Comorbidity and intellectual functioning in ADHD

Most developmental disorders are comorbid to some extent. More than two thirds of children with ADHD have at least one additional diagnosis (3, 46). Children with ADHD may have comorbidity with DCD, MR, Tourette syndrome, motor clumsiness, dyslexia, ODD, motor perception dysfunction (MPD), and learning disorders (1–3, 47). Delayed or deteriorated speech and language development is also common (48).

A higher incidence of fractures and general injuries among hyperactive children has previously been reported in several studies (49-51), but no studies on dental trauma are available.

Children with ADHD have a considerable risk of academic underachievement at school, and therefore suitable educational measures and treatments are needed (5–8). On a group level, children with ADHD have a somewhat lower IQ compared to children in a control group matched for social variables (52), but individual variability is large. In several studies reviewed by Barkley, significantly lower cognitive levels were reported in children with ADHD compared to controls, especially with respect to verbal abilities (53). Nydén et al. (54) studied clinical samples of non-mentally retarded children with autism spectrum and attention deficit disorders and found that girls were more severely affected with respect to intellectual abilities and overall functioning.

Intellectual functions in the low normal area and mental retardation

Children with a low intellectual capacity exhibit academic shortcomings in the ordinary school system, but the underlying cognitive deficits are not always identified. Many children in this group probably have intellectual functions in the low normal area, that is, IQs of 71–85. From a statistical point of view, these IQs are between -2 SD and -1 SD, and will thus encompass about 14% of the child population. In addition, children with MMR in the IQ range of 50–70 have severe learning problems. The reported prevalence of MMR varies between studies but is usually reported to be between 0.5%–2.5% in child populations (1, 26, 27).

Because pronounced deficits in attention will add to learning difficulties, it is also meaningful to diagnose ADHD in children with an IQ ≤ 70 (55). Among children with MMR, children with attention and conduct problems have poorer academic outcomes after 3 years compared to other children with MMR (56). When children with and without learning problems were compared, attention problems reported by teachers turned out to be the most important single psychosocial predictor for group discrimination. However, results varied according to the type of learning problem and the type of psychosocial problem (57).

Autism Spectrum Disorders

Autism Spectrum Disorders (ASD) implies that the child has considerable deficits in the domains of social interaction, communication (verbal and nonverbal) and profoundly restricted interests and behaviors. The three most common disorders within the ASDs are autism, autistic like conditions and Asperger´s syndrome (3).

In children with a higher cognitive ability, better verbal skills can mask significant learning and behavioral problems and mislead clinicians, teachers, and parents.

This problem of diagnose masking has been a particular problem in Asperger syndrome, where focus on the child's verbal skills may lead teachers and parents to focus on behavior problems rather than on the nonverbal learning difficulties that such children often exhibit. Knowledge of children's cognitive style may help adults prevent or significantly decrease potential behavioral challenge (25).

AIM

Despite the high prevalence of behavioral and learning problems in the child population, few studies on the oral health and behavior of such children during dental treatment have been published. The difficulties that children with attention and learning problems have make it likely that they will encounter problems coping with an unfamiliar situation such as a dental examination or treatment.

The overall objective of the present thesis was to analyze the dental behavior, such as BMP and communication, of children with attention and learning problems.

In this thesis the following hypotheses are tested:

Children with attention and learning problems have more dental BMP, more cancelled and missed appointments, and more traumatic dental injuries than a control group.

Children with attention and learning problems exhibit more problems interacting with a dentist than does a control group.

MATERIAL AND METHODS

Study design

A double-cohort design was chosen for this thesis. One cohort (i.e., the index group) comprised children who had a positive outcome in a screening for children with attention and learning problems (Fig. 1). The other cohort (i.e., the control group) consisted of children randomly chosen from the group that had a negative outcome in the same screening.

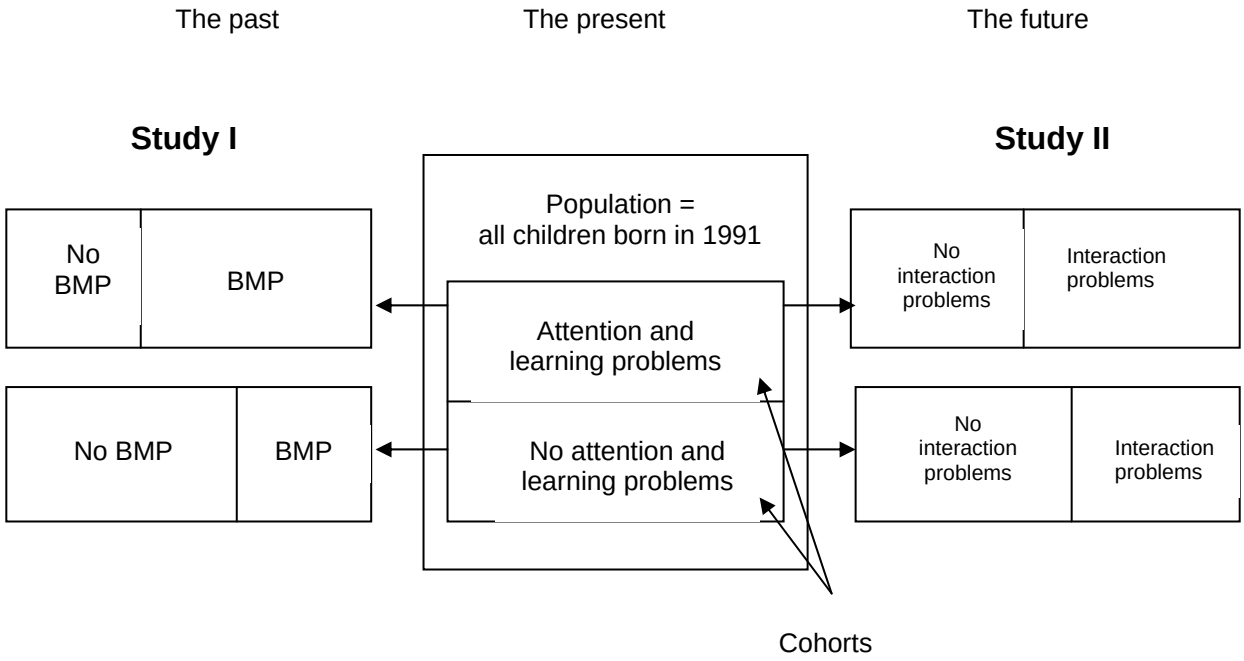

Figure 1. For this thesis, we chose a double-cohort design. We selected samples from populations with different levels of predictors (i.e., attention and learning problems) and measured the occurrences of outcome variables (i.e. behavior management problems [BMP] and interaction problems) retrospectively from dental records and prospectively during a dental appointment.

Study population

The target population comprised all 555 children (285 boys, 270 girls) born in 1991 and living in Sigtuna in 2001. The municipality has approximately 36,000 inhabitants and a socioeconomic status similar to that of the rest of Sweden and of Stockholm County. Twelve percent of the adult population had a higher education (of at least 3 years after senior high school) whilst the corresponding rate for Sweden as a whole was 15%. The proportion of

individuals with a background from a foreign country was 21% and comparable to that of Stockholm County.

Screening procedure

This thesis is part of a population-based study on behavior and learning problems in children. The screening procedure is discussed in more detail in study I. In short, children born in 1991 and attending mainstream and special schools in the municipality of Sigtuna in Stockholm County were screened for attention and learning problems during their regular health examination in 2001–2002. The screening procedure comprised two different questionnaires filled out by the parents and the teachers: Conners' 10-item questionnaire, pertaining to the child's attentional functions, hyperactivity, and behavior (1, 58, 59), and the executive function screening questionnaire (EFSS), constructed for the study to cover problems with 1) EFs, such as the child's ability to organize and plan things, the child's working memory, and the way the child relates to time, 2) inattention and passive behavior, and 3) problems with learning, such as reading, spelling, and mathematics (60). To minimize the false negative outcome of the screening, the teachers underwent an additional, semi-structured interview by a pediatrician experienced in neuro-pediatrics, about the children's behavior and school achievements, and the criteria for ADHD were added to the interview (35).

The criteria for screen positivity were chosen to identify children with attention and learning problems of different degrees. In all, 155 (boys 104; girls 51) of the children were found to be screen positive and were included in the study. Children not reaching the inclusion criteria indicating attention and learning problems were considered screen negative.

The children in the control group were randomly chosen from the screen negative children in the same school classes as the index children. When the control group was chosen in this way, the sex distribution was uneven (more boys in the index group than the control group), as more boys than girls had a positive outcome in the screening (Fig. 3). To attain a more even sex distribution between the groups in study I (Fig. 2), a new control group was selected and stratified by sex (additional boys were randomly chosen from the same Public Dental Service [PDS] clinics as the index children). However, in study II this could not be done as the data was already collected. The sex distribution in the two study groups was therefore unequal.

To ensure the anonymity of the patients, their names were substituted with registration numbers. Approval from the Research Ethics Committee of Karolinska University Hospital, Huddinge (024/02) was obtained prior to the study.

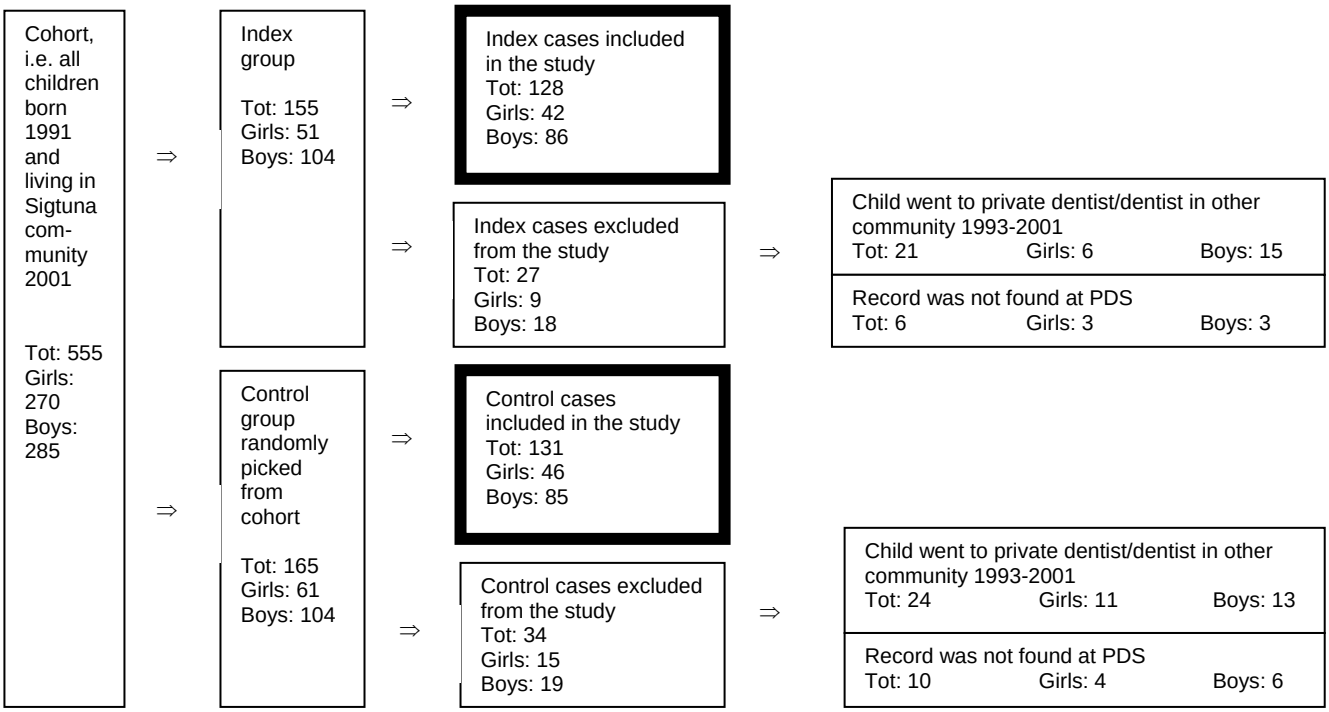

Figure 2: The study cohorts in study I, dropouts explained in detail.

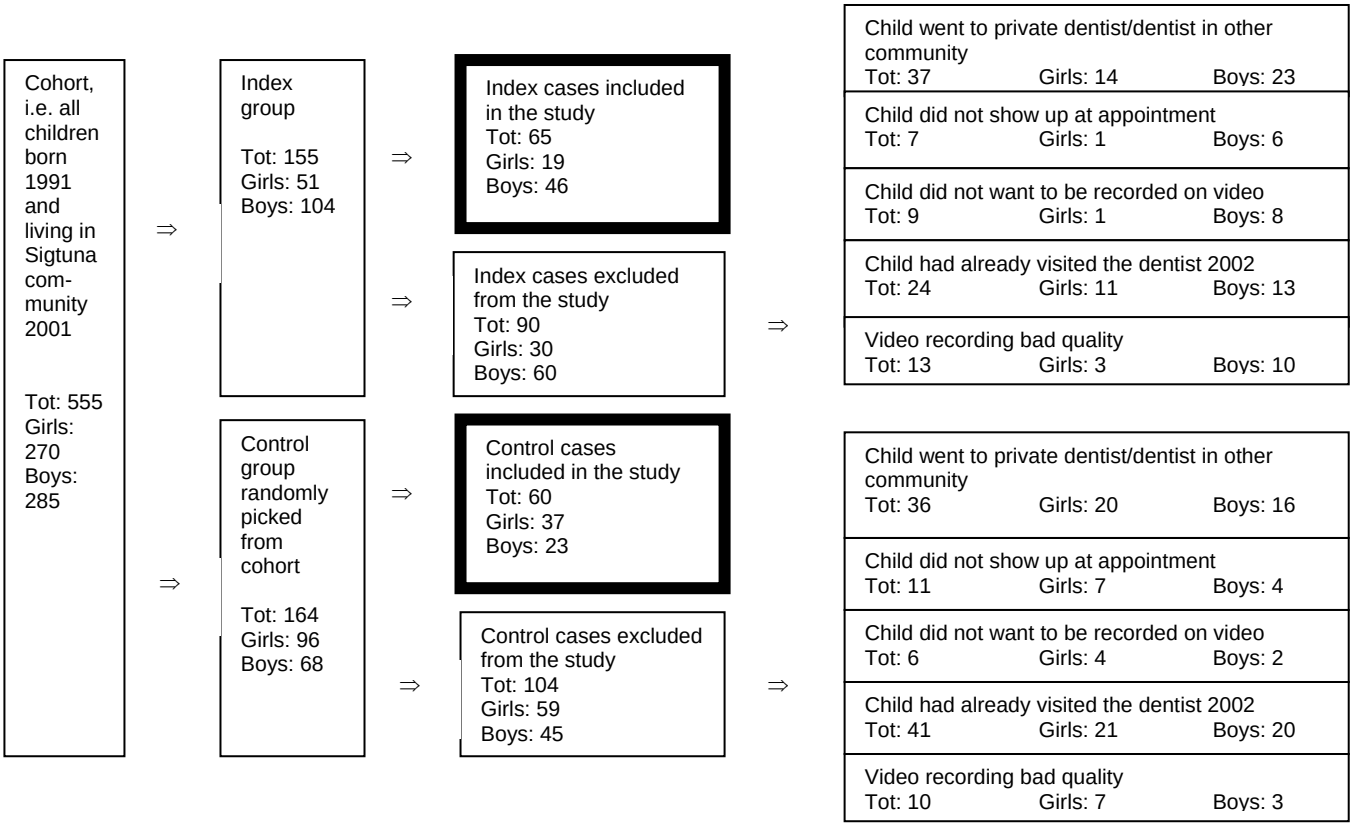

Figure 3: The study cohorts in study II, dropouts explained in detail.

Patients included in study I

The dental records of the subjects were obtained from the PDS. The study comprised 128 screen-positive index cases (86 boys; 42 girls) and 131 screen-negative control cases (85 boys; 46 girls). The control group was randomly chosen from the same PDS clinics as the index children (Fig. 2).

Swedish children aged 3–19 years are offered free dental examinations and full dental treatment on a regular, often annual basis. This care is mainly provided by the PDS but also by private dentists. The first planned dental appointment for children is at 3 years of age. The children are then called yearly up to the age of 7 and thereafter biannually by their dentist. Eighty-one percent of the dental records described 8 years or more of the child's life.

The parents of the 259 children selected for the study were given written information about the aims and procedures of the study and informed that participation was voluntary.

Patients included in study II

In study II the biannual recall visit at 11 years of age at the PDS was video recorded. Written information about the study was given to the parents of the child patients prior to the examination.

The final group for video analysis comprised 65 screen-positive children (46 boys, 19 girls) in the index group and 60 screen-negative children (23 boys, 37 girls)—randomly chosen from the same school classes as the index children—in the control group (Fig. 3).

All screen-positive children have been classified according to degree of attention problems and general cognitive level. Two groups emerged: one with generally low cognitive abilities and one dominated by attention-related problems (61). The proportions of the different subgroups of children among all screen-positive children and the index group in study II were as follows: 39% and 33%, respectively, had ADHD; 23% and 15%, respectively, had attention-related problems but not of a degree that accorded with ADHD; 29% and 41%, respectively, did not have ADHD or attention-related problems; and in 9% and 11%, respectively, information on attention problems was lacking. An IQ $\leq$ 70 was found in 9% and 11%, respectively; 71 $\leq$ IQ $\leq$ 85 in 35% and 28%, respectively, and IQ > 85 in 39% and 41%, respectively. In 17% and 20%, respectively, there were no data on IQ.

Method in study I

One examiner (MB) studied the dental records, and information on the dental appointments attended by the child between 1 and 10 years of age was collected. The examiner was blinded for the results of the screening. Data regarding number of appointments, BMP, number of cancelled appointments, number of missed appointments, and number of traumatic dental injuries was compiled based on notes in the dental records. BMP were defined as findings of notes in the records expressing disruptive behavior that delayed treatment or rendered treatment impossible (12). The number of appointments with notes on BMP and the number of attended, cancelled, and missed appointments per year were registered. The total number of scheduled appointments was also registered. Traumatic injuries were registered as number of trauma per year and the age when the trauma took place. The percentage of appointments with notes on BMP of all attended appointments per year was registered. The percentage of cancelled and missed appointments of all scheduled appointments per year was also registered.

Comparisons between the two groups were made using the Student's *t*-test and the Pearson correlation test for data on a continuous scale. When analyzing the distributions of variables in the two groups, the chi-square test was used.

Method in study II

The method of video analysis is discussed in more detail in study II and will only be described in short here.

The dental recall visit was recorded on video. The dentist, the patient in the dental chair, and the parent positioned behind and to the right of the child were seen on the films. A dental assistant was also in the room but did not interact with the child. The same dentist (MB) who was blinded for the results from the screening examined all children. The first phase of the examination was chosen for an analysis of behavior since it contained many possibilities for interaction between the dentist and the child and because it was short, about 1–2 minutes: the dentist welcomes the child and parent, the child is seated in the dental chair, the dentist explains the purpose of the examination, and the dentist lowers the back of the dental chair into a horizontal position. The time for this phase was registered.

The video recording was divided into more detailed sequences. Two psychologists, both blinded for the results from the screening, scored the interaction from the video recordings. The sequence with the most detailed level was called the interaction element (IE) and comprised one initiative (e.g. question) or one response (e.g. answer). The

IEs had different properties: 1) the IE was a statement/information, question, or request, 2) the source of the IE was the dentist or the patient, 3) the focus of the IE was to carry out the examination or to create a good relation, and 4) the IE was verbal or nonverbal. If the child actively avoided responding or simply did not respond, this was also described. An IE where the verbal and nonverbal responses the child gave were different (e.g., the child says no and nods at the same time) was called an unclear response or incongruity between verbal and nonverbal response. To quantify the interaction, all these properties were considered variables. The variables, explanations, and coding symbols are described in Table 1.

Table 1. Interaction variables

Interaction element (variables)	Explanation	Coding symbol
Syntax	Statement/information	*
	Question	?
	Request	!
	Implicit, indirect, unclear or other	◦
Source	Dentist	D
	Child	C
Focus	Dentist's focus to carry out the examination	E
	Dentist's focus to create a good relation	R
	Child's focus other or unclear	O
Type	Verbal	V
	Nonverbal	N
	Incongruity between verbal and nonverbal	I
Response	Verbal	v
	Nonverbal	n
	Incongruity between verbal and nonverbal responses	i
	No response	e
	Avoidance of response	a
Source of response	Dentist	d
	Child	c

Interexaminer agreement was assessed using paired coding of 21 different parameters. Intraexaminer agreement was tested and retested in five randomly selected cases. Weighted kappa was calculated for these comparisons. Comparisons between groups were made using the Mann-Whitney U-test.

RESULTS

Study I

Notes in the dental records on BMP on at least one occasion between 2 and 10 years of age were found in 54% (69/127) in the index group compared to 37% (49/131) in the control group ($P < 0.01$). No notes on BMP were found for the appointments at 1 year of age. Fig. 4 shows the distribution of children with BMP at different ages. A significant difference between the groups was found only at 5 years of age. With increasing age, fewer children had notes in their records on BMP; this decline was not as steep in the index group as in the control group.

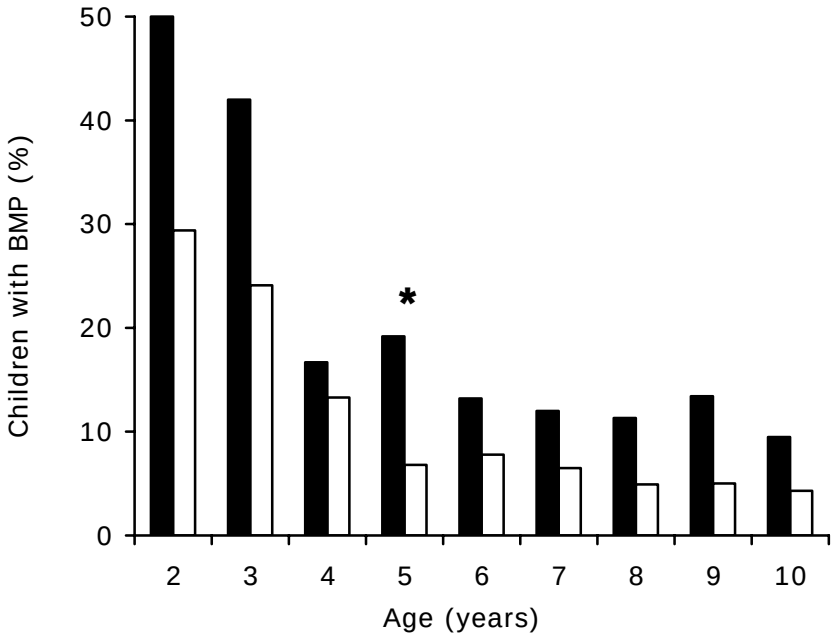

Fig. 4. Frequency (%) of children with notes in the dental records on behavior management problems (BMP) between the ages of 2 and 10 yr. Filled bars = index group, open bars = control group; chi-square test * $P < 0.05$

In the entire group studied, the cumulative percentage of the appointments registered in the dental records with notes on BMP was 13% in the index group and 7% in the control group ($P < 0.01$). Fig. 5 shows the distribution of appointments at which the children exhibited BMP according to the age of the child. The number of appointments at which the

children exhibited BMP was higher in the index group than in the control group in each age group studied; the difference was statistically significant at the ages of 3 ($P < 0.05$), 5 ($P < 0.05$), 8 ($P < 0.05$), and 9 ($P < 0.05$). Five percent (6/128) of the children in the index group were referred to a specialist in pediatric dentistry because of BMP compared to 2% (3/131) in the control group. The age at referral was significantly higher among the index children, 7.8±2.4 years of age, compared to 2.7±1.5 in the control group ($P < 0.05$).

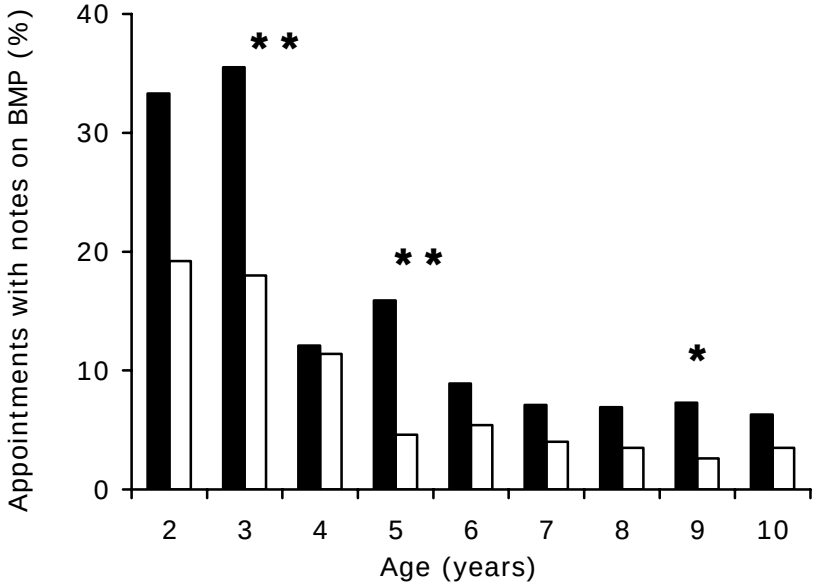

Fig. 5. Frequency (%) of appointments with notes in the dental records on behavior management problems (BMP) between the ages of 2 and 10 yr. Filled bars = index group, open bars = control group; Students *t*-test * $P < 0.05$, ** $P < 0.01$

The mean number (± S.D.) of appointments scheduled for the children from 1 to 10 years of age was 14.4±8.2 (range 1–46) in the index group and 14.3±8.3 (range 1–50) in the control group. The number of appointments attended was 11.0±5.8 (range 0–34) in the index group compared to 10.8±5.8 (range 1–41) in the control group. These differences were nonsignificant.

An analysis of the number of cancelled appointments in the same period revealed that the index group had cancelled 11.3±10.8% of their scheduled appointments while the control group had cancelled 11.8±11.5%. The index group was found to have

missed 9.2±13.9% of their scheduled appointments while the control group had missed 8.8±12.3% of theirs. Fifty-three percent of the children in both groups had missed at least one appointment during the examination period.

Among the children studied (n=259), there were no significant differences between girls and boys concerning appointments with notes on BMP or cancelled or missed appointments. Neither were sex differences found in the group of index children. No correlation between appointments with notes on BMP and missed appointments (r=0.005) was found, while a correlation was found between BMP and cancelled appointments (r=0.182, $P < 0.01$).

No statistically significant differences between the groups in number of traumatic dental injuries were found. Twenty-eight percent of the children in the index group had experienced a traumatic dental injury between the ages of 1 and 10, compared to 34% in the control group.

Study II

The time from when the child entered the surgery until the dental chair was lowered to the horizontal position was significantly longer in the group of children with attention and learning problems (107 ± 29 s) compared to in the control group (96 ± 19 s, $P < 0.05$; Table 2).

No differences were found in the total number of initiatives made by the dentist in examinations of the children from the two study groups. Neither were there any differences with regard to the number of interaction sequences per interaction phase.

With regard to the first interaction element, syntax, which takes into account that a verbal expression can have different functions, there were no differences between the two groups. Furthermore, there were no differences in the focus of the initiative by the dentist between the two groups—neither focus on the ability to carry out the examination nor focus on creating a good relation with the patient.

Children with attention and learning problems made significantly more initiatives than the children in the control group during interaction with the dentist ($P < 0.01$).

When comparing child responses with the initiatives from the dentist, we found that children in the index group made significantly fewer verbal responses ($P < 0.01$). It was also found that no-response responses to initiatives made by the dentist were significantly higher in the index group than in the control group ($P < 0.0001$). The number of unclear responses was also higher in the index group ($P < 0.01$).

Table 2. Interaction variables for children with and without attention and learning problems.

Variables	Attention and learning problems (n=65)		Control group (n=60)		Mann-Whitney *P* value
	X	s.d.	X	s.d.	
Examination time (sec)	107.0	28.6	96.2	19.3	0.0252
Total number of initiatives from the dentist	21.3	4.9	20.8	4.6	0.5254
Interaction phase					
Interaction sequences per interaction phase	2.1	0.4	2.0	0.4	0.4646
Initiatives					
Proportion of initiatives from child (%)	5	7	2	3	0.0051
Proportion of statements/information from the dentist (%)	51	11	54	46	0.0748
Proportion of questions from the dentist (%)	34	7	37	9	0.0546
Proportion of requests from the dentist (%)	12	7	14	6	0.1765
Focus of initiative					
Proportion of focus to carry out the examination (%)	49	9	49	11	0.8607
Proportion of focus for creating a good relation (%)	49	9	50	10	0.7201
Proportion of other type of/unclear focus of child (%)	2	4	0	1	0.1837
Response					
No response from child	10	8	5	6	<0.0001
Avoidance of interaction from child	1	2	0	1	0.1946
Degree of missing response from child	11	9	5	7	0.0001
Proportion of verbal responses from child (%)	21	14	29	14	0.0008
Proportion of nonverbal responses from child (%)	47	13	49	13	0.4556
Degree of coordination between verbal and nonverbal response	68	15	78	16	0.0003
Unclear response (degree of incongruity)	32	16	22	16	0.0004
Degree of non-coordination (avoidance of response, no-response and incongruity)	43	21	27	21	<0.0001

Three summary variables were also calculated: the degree of missing response, the degree of coordination, and the degree of non-coordination. The degree of missing response was found to be significantly more frequent in the index group compared to the control group ($P < 0.01$). A lesser degree of coordination, that is, a lower number of responses with coordination between verbal and nonverbal responses ($P < 0.01$) was found in the index group, as was the variable degree of non-coordination/incongruity ($P < 0.0001$).

In comparisons of the interaction between the boys or the girls and the dentist regarding initiatives from the child, we found that boys in the index group made significantly more initiatives, $6 \pm 8\%$, compared to girls, $3 \pm 7\%$ ($P < 0.05$). In the index group, the number of nonverbal responses was higher among the girls ($P < 0.01$), and the number of unclear responses was higher among the boys ($P < 0.01$). In the control group there were no significant differences between boys and girls.

DISCUSSION

The present thesis investigates the prevalence of BMP and the characteristics of communication during dental appointments in a group of children with attention and learning problems compared to a control group. The thesis comprises a retrospective dental record study and a detailed video analysis of a child's behavior during a dental recall visit.

It was found that children with attention and learning problems had more BMP during dental appointments compared to the children in a control group aged 1–10 years of age. Despite more BMP, these children neither attended nor were scheduled for more appointments. There were no significant differences in dental traumatic injuries between the two groups.

Children with attention and learning problems needed more time for a dental examination compared to a control group. The children had more unclear and fewer verbal responses. The problems in communication resulted in less two-way communication with the dentist and poor adaptation and timing compared with the interaction between the dentist and the children in the control group.

Children included in the study

The study groups were derived from a population-based sample of children with attention and learning problems in one municipality in the Stockholm County. The present thesis has a double-cohort design in which one cohort (i.e., the index group) comprised children who had a positive outcome in the screening for children with attention and learning problems. The control group consisted of children randomly chosen from the group that had a negative outcome in the same screening. Since the children in the control group were selected from the same schools and dental clinics as the children in the index group, a similar socioeconomic distribution between the two groups was expected.

The index group included children with ADHD but also children with milder forms of attention problems, children with other developmental disorders, and children with learning problems. The method of screening for attention problems, ADHD, and other developmental disorders using Conner's 10-item questionnaire has been psychometrically examined in previous Swedish studies and found to have good inter-rater and test-retest reliability (2, 61, 62). To also catch the children who might have behavioral problems, but who were not hyperactive/impulsive, a questionnaire, the EFSS, pertaining to passive and slow behavior and

to learning problems was constructed (60). When Conner's 10-item questionnaire, the EFSS, and an additional interview with the teachers, including the criteria for ADHD, were used to screen the group of children entering the study, our screen-positive group was 27% of the population examined. In addition to ADHD and milder forms of attention problems, the index group also comprised children with low intellectual functions—in the lower normal area of IQ 71-85 and in the area below an IQ of 70. The index group comprised more boys than girls, which was expected since it is reported that ADHD is more prevalent among boys (34).

In the retrospective dental record study (I) approximately 14% of the children in the index group received their dental care by private dentists and were excluded from the study. There are no data that compare the oral health or BMP of children who receive their dental care in the PDS with children treated by private dentists.

In the prospective study on interaction (II), the dropout rate of index children was high. In another report (61), cognitive data on the same index group were detailed and two groups emerged: one with generally low cognitive abilities and one dominated by attention-related problems. The index group of 65 children was considered to be representative of the 155 screen-positive children: 39% of the 65 children had ADHD compared to 33% of the 155 children; 23% had problems with attention, but not of a degree that accorded with ADHD, compared to 15%; 9% had IQ≤70 compared to 11%; and 35% had $71 \leq IQ \leq 85$ compared to 28%. The sex distribution was unequal between the index and the control groups. Differences between boys and girls in the index group were found regarding initiatives, nonverbal communication and unclear responses. The differences cannot be explained, as we do not know the specific cognitive problems of the boys and girls.

Study design

A retrospective study may cause some specific problems. First of all, it was difficult to collect all the dental records of the children. Private dentists treated some of the children, and the dental records of these children were excluded from the study. In study I, 259 of 320 dental records were identified. Second, not all dental records covered the whole life of the child. This can be explained by immigration to Sigtuna community. A dentist in another community had treated 19% of the children in the present study for the first years of their lives. The third and perhaps most significant problem with a retrospective dental record study is that the observations were made by many dentists at different clinics and each dentist will have a different attitude and experience regarding child dental care. In the present study this is mainly a problem when it comes to registration of BMP. Different dentists make registrations

in different ways, and due to different behavior by the child. Generally, notations at previous appointments of behavior problems in the dental record have usually been preceded by severe behavior problems (12).

However, a retrospective dental record study is the only convenient way to investigate BMP in children over a longer time period. An advantage of a retrospective study design is that information recall bias is decreased as the dentists who make the notes on BMP in the dental records write what they observe and not what they think is expected of them. The information bias of nonrandom/differential misclassification was decreased as the person collecting the data from the dental records was blinded to the results in the screening for attention and learning problems.

A new method was developed to record and quantify the different parts of interaction between a dentist and a child. Both the inter- and intraexaminer tests yielded a high level of agreement and high weighted kappa values.

Weinstein et al. (31) and Prins et al. (32) have previously studied behavioral interactions between the dentist and the patient in the context of dental anxiety with the help of video recordings of dental appointments. Weinstein et al. (31) developed a coding system for the observed behavior of the dentist and the child. If the dentist “reassured the child, both verbally and nonverbally” this behavior was classified as one parameter. Prins et al. (32) stated that some of the behaviors in their study needed to be differentiated more clearly to make the analysis more detailed. In the present study, the same behavior is analyzed in more detail, as it is divided into the individual interaction elements.

Dental behavior management problems

Notes in the dental records of BMP on at least one occasion between 2 and 10 years of age were found for 54% in the index and 37% in the control group. This cumulative frequency can be compared to a study on 6–8-year-old Danish children where a history of BMP was observed in 37.2% of the children (13). When comparing individual ages, the frequency of 9-year-old children with notes on BMP in the present study was 13.4% in the index group and 5.0% in the control group compared to 5.5% reported by Klingberg et al. for 9–11-year-old children (12).

Notes on BMP in the dental records were more frequent in the index group than in the control group, both when considering the number of children with BMP and the number of appointments at which each child exhibited BMP. We also found a decreasing trend in the number of appointments at which the children exhibited BMP with increasing age in the

control group. This trend was not as evident in the index group. A decreasing prevalence of subjects with BMP with age was also found in the study by Klingberg et al. (12).

Felicetti et al. (20) studied the behavior of children with ADHD during a dental visit. They found no statistical differences in behavior between children with ADHD and children without ADHD. The study was cross-sectional during a single, standardized dental visit, and the technique of registering BMP is therefore not comparable with the technique used in the present study. In the study, conducted in the United States, 21% of the children with ADHD were taking medication for their condition, which probably influenced the results of the most hyperactive children. In the study II, the proportion of children taking medication is not known, but the tradition of medicating children for attention problems is more restrictive in Sweden than in the United States.

In the present study, 5% of the children in the index group and 2% in the control group had been referred to a specialist in pediatric dentistry because of BMP. These numbers are considerably higher than the 0.8% reported earlier among Swedish children (63). In the index group, the mean age at referral was 7.8 years of age indicating an increasing difficulty of index children to cope with an unfamiliar situation at an age when they are expected to do so. Inattention and impulsivity have been associated with uncooperative children referred to special dental care in previous studies (15, 17).

Cancelled and missed appointments

Although the children in the index group exhibited significantly more BMP than the children in the control group, the index group did not have more scheduled or attended appointments. Holst et al. (64) found that “not enough time to adjust to the dental situation” was one of four variables that had a significant predictive power for BMP among 7–16-year-olds. Patients who continue to show negative acceptance should receive special attention in an attempt to change their attitude to dentistry (65).

No statistical difference was found between the index group and the control group concerning cancelled appointments. In the present study, 53% of the subjects in both groups had missed one or more dental appointment between the ages of 1 and 10 years. This can be compared to a Norwegian study (66) on 12–18-year-olds, where 47% had missed one or more dental appointment. We found no correlation between missed and cancelled appointments. This conclusion is supported by the findings of Skaret et al. (66). We did, however, find a correlation between BMP and cancelled appointments. The explanation for this phenomenon is not known. Although Arnrup et al. (15) found a different responsibility

taking profile for parents of uncooperative children compared with parents of other child dental patients, less responsibility regarding the child's unwillingness to visit the dentist was not found. It must be kept in mind that the validity of the variable cancelled appointments may be low since cancellations may not always be recorded in the notes.

Traumatic dental injuries

A higher incidence of fractures and general injuries among hyperactive children has previously been reported in several studies (49-51). In our study, 28% of index children had experienced a dental traumatic injury compared to 34% in the control group, a nonsignificant difference. In this context, it should be noticed that the index group consisted not only of children with ADHD. In a Danish population, 46% of all children had a history of traumatic injuries to primary and permanent teeth (67).

Interaction between child and dentist

The total time for the analyzed part of the video recorded examination was longer in the index group compared to the control group. When considering Barkley's description of the EFs (39, 68), it can be speculated that more time is needed for children with attention and learning problems to cope with unfamiliar situations because of dysfunctions in self-regulation and insufficient flexibility. Moreover, children with EF problems have a slower cognitive tempo, and it is hard for the child to concentrate and stay focused. It has previously been shown that the time interval between an action and a response cannot be too long in interactions with children with ADHD (69), but the results from our study also indicate that the interval should not be too short. Thus, in interactions, it is crucial to adjust tempo and timing to the child's ability to sustain attention, to focus, and to shift focus.

The children in the index group took more initiatives. A child with attention or executive problems might have difficulties comparing the present situation with earlier experiences and he or she does not have a ready model for how to act, which creates insecurity. A child who feels insecure always needs more confirmation. To take initiatives is a way to get control in an incomprehensible situation. In such a situation, the dentist should not be distracted by the numerous initiatives from the child. Instead, as a dentist, you should guide the child through the examination process with the aim of staying focused, telling him or her what you are doing as you do it and why you are doing it.

The children in the index group made fewer verbal responses, which might be a result of their limited attention and EFs. In a demanding situation, this leads to a lower degree

of simultaneous capacity, and the child must focus on either “doing or talking”. The dentist easily demands simultaneous capacity. The dentist should preferably not ask questions which forces the child to make a decision but instead be direct and more concrete, guiding the child verbally. When treating fearful dental patients, guidance to do something is usually more successful than a message to stop or slow down behavior. Findings show that specific feedback results in less fear-related behavior than general feedback (31).

The children in the index group also had less coordination between verbal and nonverbal responses and more missing responses than the children in the control group. This might be due to a difficulty to compare the present situation with earlier experience: the child does not know what is expected of him or her. The child might nod and answer “no” at the same time, and the answer becomes unclear.

Communication with the child during a dental recall visit serves two main purposes: to be able to carry out the examination and to create a good relation with the patient. A dental visit is a demanding situation for many children, but a child with good attention and executive functions can normally cope with it. Entering the room and meeting the dentist reminds the child how the procedure, for example, the dental examination, was performed the last time the child visited and thereby helps the child compare the present situation with an earlier experience. The child with cognitive limitations, such as attention and learning problems, probably cannot generate a diversity of new combinations of behavioral units out of old ones to create a future directed action (68). Such a child needs our help to be able to cope with the examination procedure. The dentist should support the child in the interaction and be clear in her or his guidance, because the situation easily becomes vague and confusing for the child.

CONCLUSIONS

Children with attention and learning problems had more behavior management problems (BMP) during dental appointments between 1 and 10 years of age compared to the children in a control group.

Children with attention and learning problems did not have more traumatic dental injuries between 1 and 10 years of age compared to the children in a control group.

Children with attention and learning problems needed more time for a dental examination compared to a control group.

The children with attention and learning problems had more unclear and fewer verbal responses.

The problems in communication with children who had attention and learning problems resulted in less two-way communication with the dentist and poor adaptation and timing compared with the interaction between the dentist and the children in the control group.

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