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Everyday- and dental-pain experiences in healthy Swedish 8–19 year olds: an epidemiological study

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Background. Very little is known about children's everyday pains and dental treatment pains. A child's gender, age, and level of dental anxiety are factors that could interplay with the perception of pain and are thus worth studying.

Aim. The objectives of this study were to investigate the frequency and reported intensity levels of children's everyday- and dental-pain experiences, and to study the reported pains in relation to gender, age, and dental anxiety.

Design. Three hundred and sixty-eight consecutive patients (8–19 years, mean age 13.5 years) from three different Public Dental Service were recruited. Pain ratings were obtained using McGrath's Children's Pain Inventory list and some additional items. Dental anxiety was estimated by the Dental Anxiety Scale.

Results. Most frequently experienced everyday pains were headache and tummy/stomach ache. Among dental treatment events, dental injection was reported to be most often ranked as painful, and more frequently by girls. Both dental and everyday pains were rated higher grouping children with high dental anxiety.

Conclusions. The frequency of pain experiences are the same in Swedish children as in other populations. There is a relation between dental anxiety and the perception of pain.

Introduction

Most children come across painful events on a daily basis. Everyday pains are pain encounters acquired in play, sports and everyday life, and differ from those caused by medical/dental treatment, or illness as they are something all children have experienced as part of normal life and thereby can relate to. They form a unique store of pain experiences. On an individual basis the experience of pain certainly varies greatly. Younger children, however, have fewer experiences compared with older children and evaluate the intensity of pain on a more intensive scale than older children[1,2]. This has been explained by a growing ability to discriminate between pains with increasing experience of it[2]. A number of studies have reported on children's self-report of pain[3–7]. The results showed that children under seven report more pain than 8–11 year olds. In addition, 8–11 year olds reported more pain than children of twelve and over. Although the pain measures in the studies vary, the results are unequivocal and suggest validity.

Every new pain encounter, whether from everyday life or specific events such as dental treatment, is evaluated and added to the individual's previous experiences. From these experiences children also find out how to stay away from or cope with objects and situations that cause pain. This is a highly purposeful and important ability in many situations, but may create problems in medical and dental situations. Thus, there is a perpetual dynamic learning process. Pain perception

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is a multifactorial and a multifaceted phenomenon and several aspects of it are not fully known. There is a complex interplay between individual external and internal factors, which are processed in the neuromatrix complex in the brain, where the pain perception is created and modulated[8]. Hence, it could be stated that external factors such as ethnic background, socio-economic situation, education, and attitudes to pain as well as internal factors such as age, gender, psychological temperament, and an individual pain perception i.e., a disposition to anxiety may play important roles.

Previous studies of common pain experiences in children and adolescents are most often derived from studies among hospitalised children diagnosed with medical conditions such as migraine, juvenile arthritis and cancer, i.e., chronic pain[2,4]. These conditions are naturally coupled with procedures and treatments able to cause acute pain *per se*. Most of the experience of acute pain is therefore collected mainly from hospitalised children. The study of common everyday pain situations, however, is uncommon. In a study of young children, Fearon (1996) observed the prevalence of everyday pain, e.g., bumps, cuts, and scrapes, and found that children who experienced these 'incidents' most frequently, also responded to them increasingly strongly[9]. This suggests that increased exposure to pain may lead to sensitisation rather than to desensitisation.

Versloot *et al.*[10] studied how two dental injection techniques, over two consecutive treatments, were rated by children aged between four and eleven. The pain scoring was assessed in relation to the children's dental anxiety, age, and previous dental experiences and to the injection site. In children younger than six interaction was observed between reported level of pain and dental anxiety. Highly anxious children, therefore, reported more pain than less anxious children[10]. A trend towards sensitised reactions between the first and second dental injections was observed among young children (> 6 years) with low levels of dental anxiety. For children aged between seven and eleven no significant differences in pain scoring were observed between the first and second dental injections.

Bergius *et al.*[11] explored the experiences of general and dental procedural pain in 12–18 year old orthodontic patients, showing that 87% of the children who had common orthodontic treatment reported pain the first evening after the intervention. The results also showed that girls rated pains higher than boys and that those who had assessed everyday pain experiences highly also experienced more orthodontic treatment pain. The findings by Fearon[9] and Bergius[11] could be interpreted as if experience and perception of everyday pains play an important role regarding apprehension of future pain experiences.

Patricia McGrath[1,2] designed a Children's Pain Inventory (CPI) to assess children's experience of a number of common pains. The CPI was constructed to tap the intensity as well as the affective dimensions of everyday pain events. The initial CPI evaluation encompassed assessments of medical and invasive treatment in groups of hospitalised children as well as in control groups. All children reported that they had experienced some kind of acute pain owing to trauma/disease. As expected, however, they reported different pain experiences. Consequently, McGrath suggested that children based their pain ratings on their own unique experiences and not on an assumed pain level[1].

In summary, there is a need to study and gain normative data regarding children's common everyday pain exposures, perceived pains and their intensity, but also the parallel exposure to and perception of dental pains. Deeper knowledge in this area can not only enhance the view of the child, but also create a better understanding of the paediatric dental care-giving situation on an individual and a group level.

Aim

The aims of this study were to investigate the frequency and reported intensity levels of everyday and dental treatment pains in 8- to 19-year-old children and teenagers attending for ordinary dental care, and to study the reported pain experiences in relation to

gender, age, and dental anxiety. Thus, the hypotheses were as given below.

1. Pain reports by Swedish children are similar to those from previously studied child populations in terms of frequency and intensity.

2. There is a relationship between children's intensity assessments of pain experiences in daily life and dentistry on the one hand, and dental anxiety, gender, and age on the other.

Patients and methods

The Regional Ethical Review Board of University of Gothenburg approved this study. Patients and parents were informed about the study procedures and that participation was voluntary and the proceedings confidential. None of the patients declined participation and all gave their informed consent.

Participants included 383 consecutive patients aged 8–19 years. The subjects were recruited from three Public Dental Service clinics in the city of Göteborg, Sweden (Table 1). The clinics were selected to reflect different social and economic backgrounds as well as different levels of oral health. The participants filled out a questionnaire at the clinics before scheduled visits for dental check ups, as described below. In few cases minor treatments were performed, however, restricted to fissure sealants or minor filling therapies. The questionnaire comprised questions on background, pain ratings, and dental anxiety, a total of 47 questions. Owing incomplete answers 15 patients had to be omitted, why the final sample consisted of 368 child and teenage patients. Gender was equally distributed, 184 girls and 184 boys, and the mean ages were 13.8 and 13.4 years, respectively (Table 2).

Background factors such as age, gender, child/parent ethnic background, and the reason for visiting the clinic were compiled. Information was also compiled on whether the child needed help from a parent or staff to answer the questionnaire or if the child answered by her/himself. A total of 141 children interacted to some degree with a parent and or dental staff during the answering procedure. It was emphasised that only the opinion of the child was to be addressed. If the child could not remember something, she/he should not be helped to remember.

Pain ratings were obtained by use of McGrath's CPI list[1] and additional items. The CPI was translated into Swedish (forward translation) by two independent researchers. The contents were checked, and the researchers agreed on a translation. This new version was tested in a pilot group of 5 children aged 8–15 years to ensure that that all questions were fully understood. Then, the Swedish version was again translated back into English (backward translation) by a bi-lingual interpreter and researcher (not involved in the forward translation) and the questionnaire was checked for errors. The CPI part of the questionnaire included the complete 23-item 'acute trauma/disease pain' list, four items from the 'acute treatment related pains' list[1], and the new item 'vaccination'. To these 28 items we added ten questions related to dental treatment situations; 'teeth polished', 'teeth probe-checked', 'tartar removed',

Table 1. Socio-economic characteristics and dental health (mean DFT) for clinics included in the study.

Clinic	Unemployment	Families receiving social allowance	Higher education	Level of dental caries	Ranking social risk	DFT (mean) 12 year
A	High	High	High	High	1	0.70
B	High	Average	High	Average	4	0.62
C	Low	Low	Average	Low	9	1.51

Unemployment, need for social allowance, higher education, and level of dental caries (based on dental caries data for all patients 0–19 year at the clinic) in relation to average of Gothenburg (High = higher SES than average for the variable, i.e., better standard, less dental caries, Low = lower SES than average for the variable, i.e., lower standard, more dental caries). Ranking of social risk – from official rankings of SES in Gothenburg (Ranking 1–11, where 1 = highest SES, i.e., lowest risk). DFT mean values for 12-year-olds from the specific clinic.

Table 2. Patient material by age, gender, parents' place of birth, and children's dental anxiety (score on Corah Dental Anxiety Scale).

Corah Dental Anxiety Scale		Gender	Children with ≥ 1 foreign national parent	DAS			
Age	*N*	F/M		Mean	SD	Median	Range
8	24	14/10	5	8.8	3.5	8.0	4–15
9	25	13/12	12	7.2	2.9	7.3	4–16
10	33	19/14	10	7.3	3.6	7.0	4–18
11	28	9/19	13	5.2	2.6	8.0	4–11
12	38	14/24	15	6.6	3.2	5.5	4–14
13	35	16/19	15	6.9	2.6	6.0	4–13
14	32	19/13	11	6.2	2.5	5.0	4–14
15	31	10/21	12	6.5	2.8	6.0	4–15
16	30	14/16	13	6.1	4.1	5.0	4–20
17	32	19/13	12	6.4	3.0	5.5	4–14
18	25	16/9	14	6.0	2.9	5.0	4–17
19	35	21/14	14	6.6	3.1	6.0	4–15
8–13	183	85/98	70	7.8	3.1	6.9	4–18
14–19	185	99/86	76	6.3	3.1	5.4	4–20
Total 8–19	368	184/184	146	7.1	3.1	5.7	4–2

'dental injection', 'tooth drilled', 'tooth restored', 'tooth extracted', 'X-ray', 'braces tightened', and 'rinsed mouth'.

The child was first asked to indicate if she/he had experienced an event, and was given the alternatives yes/no/don't know. Having experienced the event, the patient was asked to specify if it was painful by yes always/yes sometimes/no/don't know/can't remember. If the answer was yes always or yes sometimes (which reflected frequency of pain perception), the child was asked to rate the pain intensity on a 100 mm Visual Analogue Scale. A rating of 0 represented 'no pain' and 100 indicated 'worst possible pain'. This procedure is in accordance with the original scale.

Dental anxiety was estimated using the Dental Anxiety Scale (DAS)[12], and consisted of four questions, each with a 1–5 scale response alternative. Consequently, the minimum score of four represents no dental anxiety and the maximum score of 20 represents intense anxiety. The CPI was the main instrument used in this survey, and as this is a rather long and time consuming instrument to answer, DAS with its four items was chosen to assess dental anxiety. DAS has previously been used in Swedish children[13].

To assess children's ability to fill out the questionnaire a test retest procedure was performed in a larger group of children who answered the full questionnaire twice, 1 week apart. Special interest was paid to younger children and their ability to answer on the Visual Analogue Scale on CPI. For 14 children, 8–14 years of age, a Spearman correlation of 0.72 ($P < 0.01$) was calculated for the answers on item 'fallen and scraped skin' at time one and two.

Statistical methods

The data were analysed with regard to distribution of frequency of pain experience, and level of pain intensity. Differences according to sex, age, and level of dental anxiety (DAS) were tested with the chi-square test and Student's *t*-test. Predetermined significance levels were set at $P < 0.05$. Cronbach's alpha was used to estimate the internal consistency reliability. Values exceeding 0.70 were judged acceptable for group comparisons. The statistical analyses were performed with SPSS, version 12.0.1.

Results

Among the 368 children the most commonly reported experiences of everyday pain events, regardless of the level of perceived pain, were 'fallen and scraped the skin' ($N = 356$; 97%), 'bitten tongue' ($N = 352$; 96%) and 'had a cold' ($N = 350$; 95%), whereas 'had a serious

accident/injury' (N = 174; 47%) and 'other strong pain' (N = 149; 40%) showed the lowest frequencies. The experience of dental treatment events was less prevalent. The most frequently experienced dental events were 'rinsed your mouth with water' (N = 347; 94%), 'X-ray' (N = 346; 94%), and 'got your teeth probe-checked' (N = 307; 83%). Least common was 'tooth extracted' (N = 135; 37%).

Among children who had experienced an event, the distribution of the most frequent painful events as opposed to nonpainful events is shown in Table 3. The most common everyday events were reported as painful by well over 90% of the children with no statistically significant differences between boys and girls. Five everyday events, however, not among the five most frequent ones, showed gender-related differences, all of which were rated painful more often by girls (Table 3). Menstruation pain, which only relates to females, was assessed as painful by 91% (97/107) of the girls with menstruation experience. Among dental experiences the painful events all related to invasive treatment situations and the frequencies of pain assessments were lower than those of everyday events. Having had a dental injection was rated as painful significantly more often by girls than boys.

As shown in Table 4, the highest pain assessments related to 'serious accident/injury' and 'other strong pain'. These assessments were clearly higher than any other pain intensity estimates. Examples of common 'other strong pains' (open-ended) were 'fallen down from the bicycle' and 'broke the arm/leg'. The assessments of the remaining everyday pain items ranged from 57.1 'burned hand' to 26.3 'been pinched on the arm'. Menstruation was assessed by 96 girls at a VAS-level of 61.4 (SD = 27.2). Among dental pain events 'tooth extracted' was assessed as most painful (48.8) and the least was 'teeth polished' (29.0). In addition, 12 children, who reported low VAS levels, assessed the dental treatment event 'rinsed mouth' as painful. Girls rated all events as more painful compared with boys, with the exception of 'other strong pain' and 'got scratched'. Statistically significant differences according to gender are shown in Table 4.

Table 3. Distribution of the most frequent everyday- and dental-treatment pain experiences according to gender. Additional pain events showing statistically significant differences according to gender are also included. Frequency of painful experiences as a proportion of having had the experience is shown, and statistically significant differences between genders are given.

	Total		Boys		Girls		Significance		Total*	
Pain events	***N***	**%**	***N***	**%**	***N***	**%**	χ^2	***P***	***N***	**%**
Everyday events										
Headache	330/342	97	163/170	96	167/172	97	NS		164/177	88
Stubbed toe	327/347	94	169/176	96	158/171	92	NS		148/160	79
Bitten tongue	331/352	94	165/180	92	167/172	97	NS		161/180	86
Tummy/stomach ache	312/332	94	154/165	93	158/167	95	NS		154/177	82
Sore throat	326/356	92	161/178	90	165/178	93	NS			
Dental treatment events										
Dental injection	209/303	69	96/151	63	113/152	74	4.1	$P < 0.05$		
Tooth drilled	165/280	59	81/140	58	84/140	60	NS			
Tooth restored	162/286	57	80/143	56	82/143	57	NS			
Tooth extracted	138/245	56	60/111	54	78/134	58	NS			
Additional pain events with significant gender difference										
Cut your finger on a paper	262/313	84	115/147	78	147/166	89	6.1	$P < 0.05$	138/157	74
Been hit by a ball	274/340	81	134/177	76	140/163	86	5.6	$P < 0.05$	139/160	74
Got a splinter	263/343	77	125/174	72	138/169	82	4.6	$P < 0.05$	126/177	67
Got a cold	167/350	48	69/178	39	98/172	57	11.6	$P < 0.01$	70/184	37
X-ray	104/345	30	42/171	25	62/175	35	4.9	$P < 0.05$		

Total* – comparing figures. PA McGraths *et al.* A survey of children's acute, recurrent, and chronic pain: validation of the Pain Experience Interview. Pain 87 (2000) 59–73.
*Chi-square.

Table 4. Events showing the highest estimates of pain intensity (visual analogue scale assessments), and pain events showing assessments of statistically significant differences according to gender.

	Total			Boys			Girls			Significance	
Pain events	***N***	**Mean**	**SD**	***N***	**Mean**	**SD**	***N***	**Mean**	**SD**	***t***	***P***
Everyday events											
Serious accident/Injury	86	77.7	21.4	49	76.7	21.8	37	79.1	20.7	NS	
Other strong pain	99	73.7	24.0	48	74.9	24.5	51	72.6	23.8	NS	
Burned hand	223	57.1	24.6	114	54.9	26.4	109	60.6	22.3	NS	
Bee/wasp sting	224	52.3	26.7	131	49.4	27.1	93	56.5	25.7	2.0	< 0.05
Stubbed toe	320	50.4	26.4	166	50.0	25.6	154	50.9	27.3	NS	
Earache	239	49.7	27.2	125	49.7	27.3	11	49.7	27.1	NS	
Toothache	244	48.9	26.9	127	47.0	27.3	117	51.0	26.4	NS	
Stomach/tummy ache	315	47.4	33.5	158	43.7	40.7	157	51.2	23.7	2.0	< 0.05
Knife-cut to finger	256	46.3	25.0	126	46.2	26.6	130	46.4	23.4	NS	
Bitten tongue	328	43.9	25.0	162	39.6	23.7	166	48.1	25.6	3.1	< 0.01
Dental treatment events											
Tooth extracted	135	48.8	28.3	58	45.3	29.4	77	51.4	27.3	NS	
Tooth drilled	165	44.3	25.5	81	41.1	27.3	84	47.4	23.4	NS	
Dental injection	207	42.8	26.5	96	40.3	27.3	111	45.0	25.7	NS	
Tooth restored	162	40.2	24.1	80	38.1	26.6	82	42.3	21.3	NS	
Braces tightened	61	35.6	24.4	25	29.4	22.7	36	40.0	24.9	NS	
Additional pain events with significant gender difference											
Headache	330	43.1	23.6	163	38.8	22.2	167	47.2	24.3	3.3	< 0.001
Vaccination	194	39.4	26.7	96	32.3	24.8	98	46.4	26.8	3.8	< 0.001
Sore throat	309	38.7	23.3	151	35.4	23.2	158	42.0	23.0	2.5	< 0.05
Sore muscles	303	33.3	23.4	151	28.4	21.9	152	38.1	23.9	3.7	< 0.001
Teeth probe-checked	103	31.9	22.7	52	27.0	21.5	51	36.9	22.9	2.3	< 0.05

*Students t-test.

Analysis of the pain intensity assessments according to reported high or low dental anxiety (DAS median split) showed that most dental treatment pain experiences were rated higher among children who also made higher DAS ratings (Table 5). Mean for DAS was 7.1, median was 5.7. In addition, several everyday pain experiences were rated higher by children with elevated dental anxiety. The clearest differences according to DAS level were found for 'nettle sting' and 'toothache'.

Analyses according to age were performed, splitting the investigated group into younger (8–13) and older (14–19) children, according to median age. Older children generally had more pain experiences and this difference was statistically significant for eight of 28 everyday pains (most evident for 'earache' and 'chest pain'). Among dental pains only 'braces tightened' showed statistically higher frequency according to age. Age also influenced the assessment of pain intensity (VAS). The younger children commonly rated their experiences as more painful than did older children and teenagers. This age difference was statistically significant for seven of the 28 everyday pains (most obviously for 'pinched in the arm', 'hit by a ball', 'stinging nettle', but only for 'tooth extracted' among dental pains). In this case older children made higher assessments.

Because of the large variation of pain experiences in the study group, internal consistency rehabilitation analysis was performed with an *a priori* selection of the ten most frequently reported everyday pain events. This analysis included 78 cases (21%) of all 368 responders and the Cronbach's alpha was 0.88. If items were reduced or expanded (eight to twelve items) Cronbach's alpha remained on an almost identical level (data not shown). A separate analysis of the older segment of the study group ($N = 185$; fourteen and older, according to median split) to check for age effects showed a very similar outcome. This analysis included 80 cases (43% of the older children) and Cronbach's alpha was 0.89. The only difference with regard to items was the inclusion of 'pinched in the arm' in the total group, which was

Table 5. VAS assessments of dental treatment events according to high or low dental anxiety (median split and DAS). Everyday events showing statistically significant differences according to level of dental anxiety are also included. Number of assessments, VAS means, standard deviations, and test of statistically significant differences (Student *t*-test) are given. Dental treatment event 'rinsed mouth with water' not included, owing to too few assessments (*N* = 12) for sound statistics.

	Total			Low dental anxiety			High dental anxiety			Significance	
Dental treatment events	***N***	**Mean**	**SD**	***N***	**Mean**	**SD**	***N***	**Mean**	**SD**	***t***	***P***
Tooth extracted	135	48.8	28.3	68	44.0	28.0	67	53.7	27.9	2.0	< 0.05
Tooth drilled	165	44.3	25.5	82	37.8	24.9	83	50.7	24.7	3.3	< 0.001
Dental injection	207	42.8	26.5	108	36.8	24.6	99	49.4	27.1	3.5	< 0.001
Tooth restored	162	40.2	24.1	78	36.0	23.0	84	44.1	24.5	2.2	< 0.05
Braces tightened	61	35.6	24.4	43	33.3	23.8	18	41.3	25.7	NS	
Tartar removed	58	34.7	22.4	29	27.8	19.0	29	27.8	19.0	2.4	< 0.05
Teeth probe-checked	103	31.9	22.7	47	25.6	19.1	56	37.2	24.2	2.7	< 0.05
X-ray	101	29.2	23.2	51	26.0	20.3	50	32.5	25.6	NS	
Teeth polished	50	29.0	20.3	25	24.7	14.7	25	33.4	24.2	NS	
Everyday pain events											
Burned hand	223	57.7	24.6	140	55.0	24.7	83	62.2	23.8	2.1	< 0.05
Bee/wasp sting	224	52.3	26.7	143	48.2	25.6	81	59.6	27.2	3.1	< 0.01
Toothache	244	48.9	26.9	135	43.3	24.6	109	55.9	28.1	3.7	< 0.001
Chest pain	126	41.4	23.3	79	37.8	22.1	47	47.6	24.1	2.3	< 0.05
Vaccination	194	39.4	26.7	116	34.5	25.6	78	46.8	26.8	3.2	< 0.01
Scraped the skin	325	37.7	19.7	196	35.7	18.4	129	40.6	21.2	2.2	< 0.05
Nettle sting	275	34.7	25.2	166	29.9	22.0	109	42.1	28.0	4.0	< 0.001
Had a bruise	286	28.0	19.5	172	26.0	17.3	114	31.0	22.1	2.2	< 0.05

exchanged for 'cut your finger' when only the older children were included.

Discussion

This study has shown that children experience a broad range of pain experiences, from everyday life as well as dental treatments. Furthermore, there was a trend for girls to rank pains significantly higher than boys, and there seemed to be a relationship between level of dental anxiety and the perception of pain.

Primarily we investigated the frequencies and intensity levels of everyday and dental treatment related pain experiences in a group of Swedish children. Secondly, the aim was to study the influence of gender, age, and dental anxiety status on perceptions of pain.

Epidemiological surveys typically report that 10–30% of children and adolescents experience headache and stomach ache/abdominal pain more than once a week[14–17]. Our research confirmed these two common pains to be among the most frequent in the investigated children. The frequencies found in this survey (headache 96% and stomach/tummy ache 94%) were also in agreement with McGrath, who found that close to 90% of children between 5 and 16 years had experienced headache and 82% had stomach ache[1].

As expected, older children in our study had mostly experienced more pain compared with the younger. The result could be a consequence of a natural exposure increasing with age. It could also be a result of an increased incidence of psychosomatic symptoms among schoolchildren, or a combination of both, which has been discussed by other researchers[16]. In a questionnaire answered by more than 1300 Swedish schoolchildren, 47% reported one or more symptoms of recurrent abdominal pain, headache, lower abdominal pain, or chest pains[17]. It was suggested that this could partly be explained psychosomatically. Limb and back pain are also among the multiple pain experiences that are increasing in teenagers[18,19]. In a Swedish study based on 29 000 individuals, Nilsson *et al.*[20] studied a subsample of 200 children and found a prevalence of temporomandibular disorders related pain of 6% in girls compared with less than 3% in boys[20].

The fact that the younger children rated their experiences as more painful than the

older children can be discussed from different perspectives. For example, the range of the intellectual capacity to classify and express pain can be quite wide among children of similar age[21]. Nevertheless, some research points towards younger children's tendency to report extremes of the scale, owing to a more limited cognitive capacity than older children in making discriminations within the VAS range[21]. This points to a response bias of how children report pain. We therefore need more knowledge about children's capability to express pain to evaluate a possible report-bias[20–25].

From the perspective varying ages and backgrounds of the study group one could anticipate a wide range of emerged pain experiences and intensity assessments. Inspection of the range of scores indicated that the majority of pain variables scored over the entire, or large parts of the VAS-scale range. Generally, the pain intensity assessments from this study group corresponded well with previous levels reported by McGrath *et al.*[1,26]. Comparing pain assessments from this study with reports from a previous Swedish study on teenagers where ten corresponding pain items were used[11] revealed differences. While some assessments corresponded well ('vaccination', 'nettle sting'), others showed a poorer match ('cut finger', 'bee/wasp sting'). A separate comparative analysis restricted only to our teenage group (data not shown) did not alter the picture. We believe that the explanation may be that Bergius *et al.*[11] used a much smaller group of highly motivated orthodontic patients, while our patient group was larger, more population based, and less specific. Thus, comparing results from this study with previous reports the first hypothesis was confirmed, i.e., pain reports from the Swedish children were similar to reports from other study populations in terms of frequency and intensity.

While the most prevalent everyday pains in our study showed no gender differences, statistically significant differences were revealed for less frequent pains. It appeared that items related to 'sharp objects' ('probe', 'bee/wasp sting', 'knife', and 'vaccination') were prevalent among items scored higher by girls. There are no *in vivo* studies, which have examined possible differences in the perception of 'sharp' objects between the genders. Pain experimentally induced by a probe on the finger, however, has been reported to show no overall gender differences in pain rating[27]. This study also showed that a temporal summation of mechanically induced pain was higher in females than in males, suggesting a trend towards greater sensitisation in girls compared with boys.

The dental treatment pain experiences showed lower prevalence levels than common everyday pains. This was not surprising, given the generally good dental health among Swedish children, and the fact that a number of the dental items mirrored invasive treatments, which consequently are related to older children. The correlations between gender and dental pain experience were therefore both fewer and weaker than age correlations, indicating that older individuals had more pain experiences. This was further confirmed by the finding that the only dental pain, which showed a statistically significant higher frequency in the comparison of older and younger children, was 'tightened braces'. The result points to a natural cause related effect since the use of braces as a therapy begins at a later age. The frequencies of other dental pains should be expected to be more evenly distributed with regard to age.

There were no statistically significant differences between male and female pain intensity ratings of most dental treatment items, a finding well in line with Bergius *et al.*'s findings among their group of teenage orthodontic patients[11]. There were, however, statistically significant gender differences related to having experienced X-rays and dental injection. The dental injection has been identified as one of the most anxiety provoking components in dental treatment in several studies. For example, in rankings of most anxiety-provoking items of the Children's Fear Survey Schedule-Dental Subscale (CFSS-DS)[28], injection often comes out as number one (e.g., Nakai *et al.*, 2005[28]). Other highly ranked items on CFSS-DS include anxiety of choking and

drilling[28]. Chomyszyn-Gajewska *et al.* found that 70% of children aged 7–11 experienced pain when undergoing caries excavation, and that girls reported more pain than boys[29]. By contrast, Jones *et al.*[30] did not find any differences between the genders when injection associated pain was recorded and evaluated in routine dental treatments. Invasive dental treatments are, however, often ranked as painful, why in all dental treatment the dentist should use a strategy individually tailored for each patient/treatment situation to counteract a presumptive pain reaction.

A frequent observation in dental care is that a worried child often expresses anxiety and distress when expecting pain, whether from invasive or noninvasive interventions. It is well known that a fearful child is prone to perceive and rate pain intensity more strongly compared with nonfearful children[31]. Our results are in accordance with this understanding, i.e., a majority of the invasive treatment and everyday events were considered significantly more painful by children with an elevated dental anxiety, thus in line with the second hypothesis for this study.

Conclusion

Pain assessments in Swedish children were found to be in agreement with reports from other child populations, showing a broad range in pain experiences from everyday situations and dental treatment, and also a relationship between pain intensity assessments in daily life and dentistry on the one hand, and dental anxiety, gender and age on the other. Invasive dental treatments were rated as the most intense among dental treatment pains. Girls were commonly inclined to report more frequent, and more intense pains compared with boys. Our results clearly underline that dental anxiety is a reinforcer of pain perception.

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What this paper adds

- Widened knowledge about children's experiences of everyday- and dental-treatment pains.
- Insight into the interplay between dental anxiety and perception of pain's intensity insures a better communication between caregiver and patient, and thus a greater chance to a treatment with less pain.

Why this paper is important for paediatric dentists

- In order to treat each patient on an individual level, thus taking different aspects of the life situation into consideration, a widened awareness is required concerning children's pain experiences.

References

1 McGrath PA, Speechley KN, Seifert CE *et al.* A survey of children's acute, recurrent, and chronic pain: validation of the pain experience interview. *Pain* 2000; **87**: 59–73.
2 McGrath P. The multidimensional nature of children's pain experiences. In: McGrath P. (ed.). *Pain in children. Nature, assessment, and treatment*. New York: The Guilford Press, 1990: 1–40.
3 Fradet C, McGrath PJ, Kay J, Adams S, Luke B. A prospective survey of reactions to blood tests by children and adolescents. *Pain* 1990; **40**: 53–60.
4 Beyer JE, Ashley LC, Russell GA, DeGood DE. Pediatric pain after cardiac surgery: pharmacologic management. *Dimens Crit Care Nurs* 1984; **3**: 326–334.
5 Lander J, Fowler-Kerry S. Age differences in children's pain. *Percept Mot Skills* 1991; **73**: 415–418.
6 Bournaki MC. Correlates of pain-related responses to venipunctures in school-age children. *Nurs Res* 1997; **46**: 147–154.
7 Goodenough B, Kampel L, Champion GD *et al.* An investigation of the placebo effect and age-related factors in the report of needle pain from venipuncture in children. *Pain* 1997; **72**: 383–391.
8 Melzack R. Evolution of the neuromatrix theory of pain. The Prithvi Raj lecture: presented at the third world congress of world institute of pain, Barcelona 2004. *Pain Pract* 2005; **5**: 85–94.
9 Fearon I, McGrath PJ, Achat H. 'Booboos': the study of everyday pain among young children. *Pain* 1996; **68**: 55–62.
10 Versloot J, Veerkamp JS, Hoogstraten J. Computerized anesthesia delivery system vs. traditional syringe: comparing pain and pain-related behavior in children. *Eur J Oral Sci* 2005; **113**: 488–493.

11 Bergius M, Kiliaridis S, Berggren U. Pain in orthodontics. Experience of pain during an orthodontic procedure. *Eur J Oral Sci* 2002; **110**: 92–98.
12 Corah NL. Development of a dental anxiety scale. *J Dent Res* 1969; **48**: 596.
13 Blomqvist M, Holmberg K, Lindblad F, Fernell E, Ek U, Dahllöf G. Salivary cortisol levels and dental anxiety in children with attention deficit hyperactivity disorder. *Eur J Oral Sci* 2007; **115**: 1–6.
14 Roth-Isigkeit A, Thyen U, Raspe HH, Stoven H, Schmucker P. Reports of pain among German children and adolescents: an epidemiological study. *Acta Paediatr* 2004; **93**: 157–159.
15 McGrath PA, Seifert CE, Speechley KN, Booth JC, Stitt L, Gibson MC. A new analogue scale for assessing children's pain: an initial validation study. *Pain* 1996; **64**: 435–443.
16 Alfvén G. Preliminary findings on increased muscle tension and tenderness, and recurrent abdominal pain in children. A clinical study. *Acta Paediatr* 1993; **82**: 400–403.
17 Perquin CW, Hazebroek-Kampschreur AA, Hunfeld JA *et al.* Pain in children and adolescents. A common experience. *Pain* 2000; **87**: 51–58.
18 Ghandour RM, Overpeck MD, Huang ZJ, Kogan MD, Scheidt PC. Headache, stomachache, backache, and morning fatigue among adolescent girls in the United States: associations with behavioral, sociodemographic, and environmental factors. *Arch Pediatr Adolesc Med* 2004; **158**: 797–803.
19 Laurell K, Larsson B, Eeg-Olofsson O. Prevalence of headache in Swedish schoolchildren, with a focus on tension-type headache. *Cephalalgia* 2004; **24**: 380–388.
20 Nilsson IM. Reliability, validity, incidence and impact of temporormandibular pain disorders in adolescents. *Swed Dent J Suppl* 2007; **183**: 7–86.
21 Goodenough B, Addicoat L, Champion GD *et al.* Pain in 4- to 6-year-old children receiving intramuscular injections: a comparison of the Faces Pain Scale with other self-report and behavioural measures. *Clin J Pain* 1997; **13**: 60–73.
22 Chambers CT, Reid GJ, Craig KD, McGrath PJ, Finley GA. Agreement between child and parent reports of pain. *Clin J Pain* 1998; **14**: 336–342.
23 McGrath P. Abstracts and comments on Pain in Infants, Children, and Adolescents. *Paediatr Pain Lett* 1998; **2**: 25–36.
24 Jacobsen PB, Manne SL, Gorfinkle K, Schorr O, Rapkin B, Redd WH. Analysis of child and parent behaviour during painful medical procedures. *Health Psychol* 1990; **95**: 559–576.
25 Chambers CT, Craig KD. An intrusive impact of anchors in children's faces pain scales. *Pain* 1998; **78**: 27–37.
26 McGrath PA. Acute pains. In: McGrath PA. (ed.). *Pain in Children: Nature, Assessment and Treatment*. New York: Guilford Press, 1990: p. 208–249.
27 Sarlani E, Greenspan JD. Gender differences in temporal summation of mechanically evoked pain. *Pain* 2002; **97**: 163–169.
28 Nakai Y, Hirakawa T, Milgrom P *et al.* The children's fear survey schedule-dental subscale in Japan. *Community Dent Oral Epidemiol* 2005; **33**: 196–204.
29 Chomyszyn-Gajewska M, Kwapinska H, Zarzecka J. Pain perception in children during caries removal with the Vector system: a pilot study. *Eur Arch Paediatr Dent* 2006; **7**: 38–41.
30 Jones CM, Heidmann J, Gerrish AC. Children's ratings of dental injection and treatment pain, and the influence of the time taken to administer the injection. *Int J Paediatr Dent* 1995; **5**: 81–85.
31 Klaassen MA, Veerkamp JS, Hoogstraten J. Dental fear, communication, and behavioural management problems in children referred for dental problems. *Int J Paediatr Dent* 2007; **17**: 469–477.