# Fear of blood, injury, and injections, and its relationship to dental anxiety and probability of avoiding dental treatment among 18-year-olds in Norway

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International Journal of Paediatric Dentistry 2008; 18: 163–169

**Background:** More knowledge about the relationship between blood–injury–injection phobia (BIIP) and dental anxiety (DA) may give new clinically relevant information in the assessment and management of children with DA.

**Objective:** The aims of this study were to explore the relationships between BIIP and DA, and to explore to what extent the two subtypes of BIIP in combination with DA are related to self-reported probability of avoiding dental treatment if a dental injection is needed.

Blood–injury–injection phobia (BIIP) is unique compared to other specific phobias because of a characteristic vaso-vagal response with a strong tendency of fainting when the patient is exposed to the phobic stimuli<sup>1,2</sup>. The phobia has two subtypes [subtype injection (sI) and subtype blood–injury], but is classified as one diagnosis according to *Diagnostic and Statistical Manual of Mental Disorders,* 4th edition (*DSM–IV*)<sup>1</sup>. The phobia seems to have a strong genetic component<sup>2-4</sup> and is prevalent among children and adolescents<sup>5</sup>.

Studies indicate that there is an overlap between dental anxiety (DA) and BIIP<sup>6–10</sup>, and fear of injections has been reported as one of the most common sources of dental fear in childhood<sup>11</sup>. A possible explanation is that children with a tendency of fainting when exposed to a dental injection become anxious of dental treatment. This is in accordance with **Methods:** The subjects were a random sample of 1385 18-year-olds attending high schools in a county of Norway, and the data were collected by use of questionnaires completed in classrooms. The survey instruments applied were Dental Fear Survey, Injection Phobia Scale-Anxiety, and Mutilation Questionnaire. **Results:** About 11% of the subjects with DA and subtypes of BIIP, respectively, reported high probability of avoiding dental treatment in a situation where a dental injection was possibly needed. In multiple regression analysis, only DA contributed to self-reports of high probability of avoiding dental treatment. **Conclusion:** The results indicate that among adolescents, BIIP is relatively often connected with DA. Clinical implications are discussed.

Kleinknecht and Lenz<sup>12</sup> who found that 'fear of fainting' is a factor contributing to fear of needles. Because of the specific vaso-vagal response, these patients may need a different treatment approach compared to other patients with DA and phobias<sup>4</sup>.

The prevalence of BIIP in adolescents has rarely been estimated, but Agras *et al.*<sup>5</sup> reported the incidence of what they called common fears of injections to be about 13% among 10- and 20-year-olds. In a previous study among adolescents in Norway, we found that the prevalence of self-reports of fainting and almost fainting during a dental or medical injection was 17% in this age group<sup>13</sup>. The facts that the prevalence of BIIP is estimated to be higher among children and adolescents compared to adults<sup>5</sup>, and that there is an overlap with DA, indicate that more knowledge is needed in this area of paediatric dentistry.

There are lots of empirical evidence for the strong relationship between DA and avoidance of dental care<sup>3,12,14-16</sup>. A possible overlap between BIIP (and its subtypes) and DA among adolescents may indicate that BIIP may also contribute

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to avoidance of dental care. Our previous findings that 3.3% of 18-year-olds reported avoidance of dental treatment when a dental injection is needed, support this hypothesis<sup>13</sup>. The aims of this study were to estimate the prevalence of BIIP among adolescents, and to explore its possible relationship to DA. Furthermore, we wanted to study the extent to which DA and the two subtypes of BIIP are related to selfreported probability of avoidance of dental treatment if a dental injection is needed.

## Materials and methods

## Sample

The subjects in this study were drawn as a random and proportional cluster sample from a population of adolescents born in 1983 (18-year-olds) and attending high schools in the county of Hordaland in Norway. The sample consisted of 1385 participants (770 girls). The proportionality refers to the main classification of municipalities from Official Statistics of Norway<sup>17</sup>, and the clusters refer to high schools. Forty-six of 48 high schools participated in the study, and only four adolescents in these schools declined to participate.

# Study design

The data in this study were collected by use of questionnaires completed in the classroom under supervision of the first author (M.V.). A standard introduction outlining the purpose of the study and the anonymity of the subjects was given. Permission to distribute the questionnaires and to collect data was given by the county chief of schools and the headmaster of each school. The study design and data collection procedure was approved by the National Committees for Research Ethics in Norway.

## Survey instruments

The questionnaire included variables measuring DA, injection phobia, blood–injury phobia, and self-reported probability of dental avoidance. The following groups of variables and self-report instruments were included in this study. For measuring DA, the Dental Fear Survey (DFS)<sup>18</sup> was applied. DFS (20 items) is well-validated and shows good test–retest reliability, and normative score for adults in Norway is 44.6<sup>19,20</sup>. A DFS score of 60 or more was in this study used as the criterion for DA<sup>21–23</sup>.

To assess injection phobia, the Injection Phobia Scale-Anxiety (IPS-A)<sup>9</sup> was used. IPS-A is an 18-item questionnaire assessing fear of injections, and a score of 25 or more has been used as a criterion for injection phobia<sup>9,24</sup>. Subjects with injection phobia based on this criterion are in this paper classified as sI.

The Mutilation Questionnaire (MQ)<sup>25</sup> has 30 items, and is a frequently used instrument for assessing blood–injury fear and phobia<sup>26</sup>. Subjects with a score of 19 or more were classified with blood–injury phobia<sup>24</sup>, which in this paper are labelled subtype blood–injury (sBI).

# Probability of avoidance of dental care

The respondents were asked the following question: 'You have a tooth problem and have or recently had severe toothache. What is the probability of proceeding with dental treatment in a situation when a dental injection is needed?' (6-point scale: 100%, 80%, 60%, 40%, 20%, or 0%). Based on the distribution of the data, the avoiders were defined by the following criterion: self-reports of  $\leq$  40% probability of being willing to proceed with dental treatment if an injection was needed.

## Statistical analyses

Statistical analyses were performed using SPSS, version 14.0 (SPSS, Chicago, IL, USA). Group differences were analysed with one-way analysis of variance. Chi-squared tests, Pearson's correlation, and Fishers Z-test for two correlations were employed to assess the relationships and differences between groups of subjects with DA, sI, and sBI. Simple logistic regression analyses were used to explore the bivariate associations between the dependent variable dental avoidance (self-reports of  $\leq$  40% probability of being willing to proceed with dental treatment if an injection was needed). Then, a multiple logistic regression model was used to determine the individual predictive power

dependent variable. The independent variables were dichotomized based on criteria previously reported in the literature<sup>9,21-24</sup>. Odds ratios (ORs) were considered to be statistically significant if both values of the 95% confidence interval were greater than or less than 1.

### Results

#### Prevalence data

DA, sI, and sBI. The prevalence of DA, sI, and sBI according to gender is shown in Table 1. The mean of DFS was 44.2 [standard deviation (SD) = 17.6]. About 20% of the subjects were classified as having DA, significantly more girls than boys.

The mean score of IPS-A was 16.1. Eleven percent of the subjects were classified with sI. The gender difference was statistically significant, with higher scores for girls compared to boys.

The mean score of MQ was 9.8 (SD = 5.8). About 9% were classified with sBI, with significantly more girls than boys.

## Self-reported probability of avoiding dental treatment

A total of 3.3% of the adolescents (4% of the girls and 2.5% of the boys) reported a high probability of avoiding necessary dental treatment when a dental injection was needed; 67% of these avoiders were girls.

Fear of blood, injury, and injections

There were statistically significant correlations between the scores of all three self-report scales. The strongest correlation (r = 0.65) was between the scales measuring sI (IPS-A) and sBI (MQ). This correlation was significantly stronger than the correlations between DA and sI (r = 0.57), and between DA and sBI (r = 0.52) (Fishers *Z*-test for two correlations, Z = 1.97).

Subjects with DA had significantly higher mean scores on the IPS-A and MQ scales compared to the no DA subjects (Table 2). Girls with DA had higher mean MQ scores compared to boys (F(1, 265) = 24.61; P < 0.001). Table 3 displays the percentages of overlap between DA and the sI and sBI. Of the 268 subjects with DA, 41 (15.3%) also reported both sI and sBI. All the differences were statistically significant (P < 0.001).

## Relationship between DA, sI, sBI, and self-reported probability of avoiding dental treatment

The distribution of subjects reporting high probability of avoiding dental treatment if an injection was needed (avoiders) compared to subjects reporting low probability of avoidance (non-avoiders) in the three groups (DA, sI, and sBI) is shown in Table 4. About 11% of each of the groups with DA, sI, or sBI, respectively, reported high probability of avoiding dental treatment if an injection was needed.

Table 1. Mean [standard deviation (SD)] scores of Dental Fear Survey (DFS), Injection Phobia Scale-Anxiety (IPS-A), and Mutilation Questionnaire (MQ), and the frequencies of dental anxiety (DA), subtype injection (sl), and subtype blood-injury (sBI) according to gender.

	Girls Mean (SD)	Boys Mean (SD)	Total Mean (SD)	Statistics
DFS*	47.6 (18.4)	40.0 (15.6)	44.2 (17.6)	<i>F</i> (1, 1351) = 65.3; <i>P</i> < 0.01
IPS-A†	19.1 (14.1)	12.3 (11.7)	16.1 (13.5)	<i>F</i> (1, 1375) = 92.0; <i>P</i> < 0.01
MQ‡	11.6 (6.1)	7.6 (4.6)	9.8 (5.8)	<i>F</i> (1, 1375) = 181.0; <i>P</i> < 0.01
	n (%)	n (%)	n (%)	
DA	198 (26.4)	69 (11.5)	267 (19.8)	$\chi^2 = 46.90; P < 0.001$
sl	107 (14.0)	44 (7.3)	151 (11.0)	$\chi^2 = 15.53; P < 0.001$
sBI	116 (15.1)	14 (2.3)	130 (9.4)	$\chi^2 = 65.15; P < 0.001$

\*Cut-off score > 60.

+Cut-off score > 25.

‡Cut-off score > 19.

		DA Mean (SD)	No DA Mean (SD)	Statistics
sl*				
	Girls	30.4 (14.8)	14.9 (11.3)	<i>F</i> (1, 748) = 230.3; <i>P</i> < 0.01
	Boys	26.4 (16.8)	10.4 (9.5)	<i>F</i> (1, 598) = 140.2; <i>P</i> < 0.01
	Total	29.3 (15.3)	12.7 (10.7)	<i>F</i> (1, 1354) = 430.4; <i>P</i> < 0.01
sBI†				
	Girls	15.9 (6.0)	10.1 (5.5)	<i>F</i> (1, 748) = 159.6; <i>P</i> < 0.01
	Boys	11.8 (5.8)	7.1 (4.1)	<i>F</i> (1, 601) = 73.8; <i>P</i> < 0.01
	Total	14.8 (6.2)	8.6 (5.1)	<i>F</i> (1, 1354) = 299.1; <i>P</i> < 0.01

\*Cut-off score > 25.

+Cut-off score > 19.

Table 3. Cross tabulation between numbers of subjects (%) with dental anxiety (DA), subtype injection (sI), and subtype blood–injury (sBI) groups.\*

	IP % (n)	Non-IP % (n)	Total
DA	29.6 (79)	70.4 (188)	19.8 (267)
Non-DA	6.1 (66)	93.9 (1017)	80.2 (1083)
Total	10.7 (145)	89.3 (1205)	100 (1350)
	sBl	Non-sBI	
	% (n)	% (n)	Total
DA	30.2 (81)	69.8 (187)	19.8 (268)
Non-DA	4.4 (48)	95.6 (1040)	80.2 (1088)
Total	9.5 (129)	90.5 (1227)	100 (1356)
	sBl	Non-sBl	
	% (n)	% (n)	Total
sl	40.0 (60)	60.0 (90)	10.9 (150)
Non-sl	5.6 (69)	94.4 (1153)	89.1 (1222)
Total	9.4 (129)	90.6 (1243)	100 (1372)

\*All differences are statistically significant at the P < 0.001 level.

Table 4. Frequencies (n, %) of dental avoiders and nonavoiders in the dental anxiety (DA), subtype injection (sI), and subtype blood-injury (sBI) groups.

	Avoiders	Non-avoiders	Significance
DA	30 (11.2)	237 (88.8)	<i>P</i> < 0.001
sl	17 (11.3)	134 (88.7)	<i>P</i> < 0.001
sBl	14 (10.9)	115 (89.1)	<i>P</i> < 0.001
Total	46 (3.3)	1310 (96.7)	<i>P</i> < 0.001

The bivariate relationships between the independent variables and the dependent variable avoidance of dental treatment when a dental injection is needed (with toothache) are shown in Table 5. The following variables were positively related to avoidance (ranked according to OR): Table 2. Mean [standard deviation (SD)] scores of the scales measuring subtype injection (sl) and subtype blood-injury (sBl) among subjects with dental anxiety (DA) and subjects without dental anxiety (No DA).

DA, sI, and sBI, and gender. The highest OR were found for DA and sI, OR = 9.06 and OR = 5.22, respectively.

In the multiple logistic regression analysis with the same dependent variable, DA, sI, and sBI were independent variables when controlling for gender (Table 6). DA was the only factor that was significantly related to being included in the avoider group (OR = 6.7). Additional analyses including interaction terms in the model (DA × gender, DA × sI, and sI × gender) did not change this result.

#### Discussion

This study was based on a large random sample of 18-year-old adolescents in a Norwegian county. We wanted to explore the relationships between DA and the subtypes of BIIP, and to evaluate to what extent these subtypes may contribute to adolescents' self-reports of high probability of avoiding dental treatment in a situation when a dental injection is needed.

The strong overlaps between the scales, and the fact that the adolescents with DA reported higher mean scores of the IPS-A and MQ scales compared to subjects who were not dentally anxious, indicate a relationship between both subtypes of BIIP and DA. Even if this work does not establish a basis for conclusions about the aetiology of DA, it indicates that the genetically based BIIP may be a background factor for some children to become dentally anxious when exposed to dental injections. And, because fainting during exposures to blood, injury, and injections is a relatively frequent symptom of BIIP, it may be important for the clinical dentist Table 5. Bivariate analyses of factors related to being included in the dental avoider group.

			Odds	95% Confidence
Variable	n	β	ratio	interval
DFS				
DA (score 1)	267	2.20	9.06	4.80-17.10
Non-DA (score 0)	1088			
IPS-A				
sl (score 1)	151	1.65	5.22	2.80-9.74
Non-sl (score 0)	1221			
MQ				
sBI (score 1)	129	1.53	4.63	2.40-8.93
Non-sBI (score 0)	1250			
Gender				
Girls (score 1)	770	0.13	1.14	0.84–1.55
Boys (score 0)	615			

DA, dental anxiety; DFS, Dental Fear Survey; IPS-A, Injection Phobia Scale-Anxiety; MQ, Mutilation Questionnaire; sBI, subtype blood-injury; sI, subtype injection.

Table 6. Multiple logistic regression analyses of factors related to being included in the dental avoider group.

Variable	n	β	Odds ratio	95% Confidence interval
DFS				
DA (score 1)	267	1.90	6.71	3.32–13.6
Non-DA (score 0)	1088			
IPS-A				
sl (score 1)	151	0.71	2.03	0.98-4.24
Non-sl (score 0)	1221			
MQ				
sBI (score 1)	129	0.43	1.54	0.71–3.36
Non-sBI (score 0)	1250			
Gender				
Girls (score 1)	770	-0.12	0.89	0.50–1.58
Boys (score 0)	615			

–2LL: 339; 96% correctly predicted; Nagelkerke's  $R^2 = 0.16$ . DA, dental anxiety; DFS, Dental Fear Survey; IPS-A, Injection Phobia Scale-Anxiety; MQ, Mutilation Questionnaire; sBI, subtype blood–injury; sI, subtype injection.

to take this into consideration when taking the history about children who are afraid of the injections, in order to enable preventive actions.

Girls with DA had significantly higher mean scores of the MQ scale compared to boys. This result is in accordance with a study by McNeil and Berryman<sup>27</sup> who found that mutilation fears were a significant factor in DA, although only in women.

The results also showed that patients reporting either subtypes of BIIP or DA are potential avoiders of dental treatment because of fear of oral injection. In the bivariate model, both DA and the BIIP subtypes were significantly related to avoidance. In the multivariate model, however, only DA showed significant predictive power. The significance of BIIP for avoidance is therefore difficult to assess. It may be indicated that children with fear of the needle are afraid of going to the dentist because they evaluate the dental visit as representing a potential risk of having an injection, and that this is part of the reason for their high score on the DFS.

A possible interpretation of the relationships between BIIP subtypes and DA, and self-reported probability of dental avoidance found in this study is illustrated in Fig. 1. Of the 268 subjects with DA, 29.6% also had sI, whereas 30.2% also had sBI, and the avoidance group comprised subgroups of about equal sizes (about 11%) of DA, sI, and sBI, respectively. These frequencies indicate that other factors are strongly related to both DA and avoidance of dental care. According to the literature, these other factors are based on vicarious and modelling experiences and information/instruction<sup>11,28</sup>, but with previous experiences of pain and perceived lack of control as the major factors<sup>15,29</sup>. Because the age of onset of BIIP is reported to be lower than for DA<sup>1,30</sup>, a possible interpretation may be that there are subgroups of children with subtypes of BIIP that may have increased risk of developing DA. Based on the present results, however, the direction of the relationship between DA and aspects of BIIP is still unclear, and only studies with longitudinal designs may add more information to this question.

The methodological limitation of this study is that the IPS-A scale is primarily capturing



extra-oral injection phobia, as only one of the 18 items is directly related to intra-oral injections. This may have influenced the lack of difference in overlap between DA/sI compared to DA/sBI. The strongest overlap was found for sI and sBI with almost 47% of the subjects with sI also having sBI. This is in accordance with previous research<sup>2</sup> and supporting the DSM-IV diagnostic criteria, where sI and sBI are seen as one diagnostic entity, separated from DA. The strength of the overlaps was also manifested by the correlation analyses, showing that the strongest correlation was between the IPS-A and MO scales. Furthermore, this study only measured predictions of future avoidance, and the interpretation of self-reports of high probability of future dental avoidance should be done with caution. Self-reports do not necessarily reflect the true avoidance behaviour, because they are given in the classroom, and for most of them in a situation without toothache and probably far away from the dental office. The exact predictability of the respondents' probability of really avoiding dental care is unknown. Furthermore, the question regarding the assessment of possible dental avoidance because of fear of injections also included a situation with toothache. Because fear of pain and DA are closely related<sup>23</sup>, previous experiences of pain may also have influenced the adolescents' evaluation of the probability of avoidance of treatment.

The results of this study are probably representative for 18-year-olds in Norway and cannot be extrapolated to younger children. However, in a study by Lapouse and Monk<sup>31</sup> it was reported that a mild fear of blood was present in 44%

**Fig. 1.** A model showing a possible relationship between subtype injection (sl), subtype blood-injury (sBI), dental anxiety (DA), and avoidance based on a clinical interpretation of the results (Tables 3 and 4).

of 6- to 8-year-olds, and in 27% of the 9- to 12-year-olds. This is also in accordance with a study by Muris *et al.*<sup>32</sup>, and it possibly indicates that the clinical challenges of BIIP may appear more frequent among younger children.

In conclusion, the results of this study suggest that DA relatively often may be connected with aspects of BIIP, especially among girls. This may be important for the clinical evaluation of children with coping problems related to dental injections and to the fear treatment approach. These children should be asked about their previous experiences related to vaccines, needles, and blood, and they may need adjusted behaviour management techniques in order to prevent fainting, for example, applied tension as suggested by Öst and Sterner<sup>33</sup>.

#### What this paper adds

- The study describes the prevalence of BIIP (and its subtypes) among 18-year-olds.
- The data demonstrate that BIIP is strongly related to DA among adolescents.
- The results indicate that BIIP in children may increase the risk of developing DA and dental avoidance behaviour when an oral injection is needed.

#### Why this paper is important to paediatric dentists

- Paediatric dentists should be aware that children with a genetically predisposition of blood-injection phobia may experience an injection as very unpleasant because of a characteristic vaso-vagal response (fainting).
- Children with DA and strong anxiety response when exposed to an oral injection may in fact suffer from BIIP.
- Because children suffering from blood–injection phobia may need adjusted behaviour management techniques to prevent fainting, they should be asked about their previous experiences of negative bodily sensations related to vaccine, needles, and blood.

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