Overjet and incisor position as predisposing factors for dental trauma
A retrospective study in orthodontically treated children

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Abstract

Most previous studies have shown the prevalence of traumatic dental injuries in maxillary incisors to increase with increased overjet and inadequate lip coverage. The purpose of this study was to examine this issue of dental injury by journal data in orthodontic patients. This study identifies 47 children and adolescent age 7-19 years from a clinic population of 469 subjects, who had suffered trauma to maxillary incisors. Journal, study models and cephalograms of patients were used. The study population consisted of two groups of orthodontic patients, patients with injured incisors (trauma patients) and patients with no history on trauma to maxillary incisors. (controls). They were selected from the same clinic population. The controls were age and sex matched with trauma patients. The size of overjet, adequacy of lip coverage, cephalometric skeletal, dental and soft tissue measurement was made. The variables in groups T and C were compared and their predictive values from possible occurrence of trauma was tested by logistic regression analysis. The prevalence of injuries was 10.5 per cent. Boys had higher trauma frequency than girls. We found no significant difference between trauma patients and controls in the amount of overjet, lip coverage or any of the cephalometric variables.
Introduction

Epidemiological studies show that dental trauma is a serious public problem causing psychological, aesthetic, social, and therapeutic problems (Soriano et al. 2004).

Incisor trauma may result in pain, disfigurement, poor aesthetics, speech, and psychological effects (Shaw et al. 1980).

Dental injuries occurs more often in the maxilla than in the mandible, and the upper central incisors are the teeth most commonly injured (Lorne et al. 2003. Borssén et al. 1997, Baus et al. 2004).

Possible explanations might be the low prevalence of Class III malocclusions, implying natural protection of the mandibles incisors in most subjects, combined with the relative prominence of the maxillary central incisors (Årtun et al. 2005).

Årtun et al. (2005) suggested that the odds of maxillary incisor trauma before adolescence is 3.7 times higher in subjects with overjet larger than 9.5mm, and 2.8 times higher in subjects with overjet 6.5 to 9.0 mm compared with subjects with normal overjet. Most of the affected subjects had only one injured tooth and most of the traumatized teeth were maxillary central incisors. Maxillary central incisors tend to erupt earlier than the maxillary lateral incisors and thus are at risk for a longer period of time. The morphology and location of the central incisors in maxilla make them susceptible to a range of traumatic injuries, including fractures of enamel and / or dentin, pulp exposure, luxation and avulsion (Kania et al. 1996).

Dental trauma is more frequent in primary dentition than in mixed and permanent dentition at a 30-45% of all cases (Kungel et al. 2006).
The trauma prevalence is highest between 2 and 3 years of age (Flores 2002). Trauma to primary dentition may cause dislocations, luxation, premature tooth loss or discoloration of the permanent successor. According to different studies the prevalence of dental injuries in the permanent dentition is 10% to 35% (Petti et al 1996). Peak incidence is between 7 to 12 years, tends to increase until 10 to 12 years. Trauma prevalence is higher in boys than in girls (Forsberg and Tedenstam 1990, Borssén et al 1997 Cortes 2001). The WHO classifies traumatic dental injuries based on the main injury sustained by the affected tooth. A distinction is made between trauma to the hard tooth substance, either with or without injury to the pulp, and trauma to the periodontal ligament. Diagnoses may include on the one hand uncomplicated or complicated crown fractures, root fracture and crown root fracture, and on the other hand concussion, subluxation lateral luxation, intrusion or complete luxation. Most common dental trauma in the permanent dentition is crown fractures, approximately 80-90% of cases. Despite instances of unsatisfactory restorative treatment concerning aesthetics, the prognosis for affected teeth is good. Crown fracture seldom affects the planning of orthodontic treatment. In 15% of cases complicated crown fractures lead to exposed dental pulp. It is an indication for endodontic treatment which does not prevent later orthodontic tooth movement provided the root canal treatment is adequate. A traumatized tooth can be moved orthodontically with minimal risk of resorption, provided the pulp has not been severely compromised (infected or necrotic). If there is evidence of pulp necrosis, appropriate
Endodontic management is necessary prior to orthodontic treatment.

If a previously traumatized tooth exhibits resorption, there is greater chance that orthodontic tooth movement will enhance the resorptive process. If a tooth has been severely traumatized (intrusive luxation or avulsion) there may be a greater incidence of resorption, with or without root canal treatment. (Hamilton, Gutmann 1999).

Crown and root fractures account for proximally 5% of all dental traumas. The teeth usually show pulp exposure. An orthodontic extrusion can improve the pre-prosthetic condition via supragingival crown margin replacement. Subsequently, a six month retention phase and conservative or prosthetic treatment can be necessary.

Root fractures are much rarer at 0.5–7% of cases, and they heal with connective tissue or with a hard tissue. 16-22% of teeth fail to heal.

Observation period of an affected tooth prior to orthodontic treatment should last at least 1 to 2 years (Kunger et al 2006).

Dislocation injuries (luxation) accounts for 15-40% of cases.

In the 15-59% endodontic treatment is necessary.

Successful endodontic treatment usually does not present any problem for later orthodontic treatment. (Robertson et al 2002).

Before starting orthodontic treatment the affected teeth should be observed for six months to one year. 1-11% of dislocated teeth develop ankylosis, which can hinder orthodontic treatment.

Intrusion trauma is often followed by pulp necrosis. Endodontic treatment must be carried out within seven to ten days. If a pulp necrosis is treated too late, an inflammatory root resorption may occur. The prognosis and
treatment depends on root growth and extent of intrusion.

If root growth is incomplete and intrusion mild it is possible to wait for a spontaneous re-eruption. Otherwise, the treatment with active orthodontic extrusion within two weeks should be carries out.

Avulsion is a very rare dental trauma, accounting for 0.5 - 16% of cases. The consequence is almost always pulp necrosis.

The prognosis depends on how the patient store the tooth after injury, and stage of root development at the time of injury,

With non physiological storage (chlorhexidine, alcohol) the chances of pulpal revascularization are minimal. With storage in physiological media (saline, saliva), there is only a weak relationship between the duration of storage and chances of pulpal revascularization.

The relationship between the diameter of the apical foramen and the chance of pulpal revascularization apparently is an expression of the size of the contact area at the pulo-periodontal interface, whereas the length of the root canal probably reflects the time necessary to repopulate the ischemic pulp. With a favourable ratio, broad apical foramen and short root canal versus a narrow apical foramen and long root canal the odds for an intervening pulpal infection are reduced (Andreasen and Andreasen 1994).

Replacement or inflammatory root resorption of a reimplanted tooth may develop even after 20min extra-alveolar period (Andreasen JO 1980), and an interval of two hours will result in an extensive ankylosic reaction (Andreasen JO 1975).

Replanted teeth are prone to become anchylotic, a factor that can render orthodontic treatment impossible (Kunger et al 2006).

Factors that are claimed to predispose to injuries of the permanent maxillary
incisors include dental protrusion, large overjet especially in combination with lip incompetence.

Deaning et al, 1984 shows that degree of lip coverage of the maxillary incisors plays a major role in dental trauma.

They found that children between seven to ten years, who have increased overjet more than 6mm and less than one-half of their maxillary incisors covered by upper lip at rest may be regarded as risk patients, especially if they are boys.

According to the results of other studies the main risk for dental injuries is large overjet (Järvinen 1997, Forsberg and Tedenstam 1993).

Forsberg et al (1993) showed that overjet exceeding 4mm is a factor which significantly increase susceptibility to traumatic dental injury, and children with overjet greater than 5mm exhibit more severe injury.

This study also indicated that mouth breathing was related to the prevalence of dental injuries, however only weakly.

The trauma frequency for children who are nose breathers was 16.6% whereas the frequency in mouth breathers was 20.5%.(p< 0.05).

According to Järvinen (1978) the frequency of injuries was 14.2% in children with normal overjet (0-3mm), 28.4% in children with increased overjet (3-6mm) and 38.6% in children with extreme overjet (>6mm). He also determined that the range of injuries increased in relation to the overjet.

Burden (1997) found that 29% of children with inadequate lip coverage had received a traumatic injury to their incisors compared to 10% of those with adequate lip coverage.

He also found that lips which failed to cover and protect the
incisor teeth had a greater predictive value than the size of overjet.

Although inadequate lip coverage and increased overjet are both risk factors in relation to traumatic injury, children with inadequate lip coverage and increased overjet have greater risk of trauma than children presenting only one of these features.

Some authors have found correlation between trauma and demographic and socio-economic characteristics.

Kania et al (1996) found that non-Caucasians had slightly higher prevalence of incisor trauma than Caucasians.

Alonge et al (2001) found that the prevalence of incisor trauma was higher in non-Hispanic Blacks and Hispanic than Whites.

They also found that children in lower socio-economic groups had a higher prevalence of incisor trauma than those in higher socio-economic groups.

On the contrary Cortes (2002) found that Brazilian children from higher socio-economic groups had greater odds of incisor trauma than children from lower socio-economic groups.

Marcenes and Murray (2001) found that living in an overcrowded household was associated with incisor trauma in British adolescents.

In the primary dentition, luxation is most common, and acute treatment is traditionally restricted to extraction of the traumatised tooth and/or observation of the condition. However, a few of these injuries will elicit demands for treatment in the permanent successors as a consequence of disturbances in development of eruption or misalignments.

In the permanent dentition, the majority of traumatic incidents result in crown fractures, which typically are treated according to extent of hard tissue loss with grinding, composite restorations veneers or some type of
fixed or removable prosthesis.

Luxation injuries are less common in the permanent dentition, but when they occur, endodontic complications are common.

Trauma leading to instant tooth avulsion or during the follow-up period of a traumatized tooth is less common.

Whenever it occurred it will most probably result in the need of a replacement in the form of a removable denture, fixed prosthesis, implant, an autotransplanted tooth. If the conditions for orthodontic space closure are favourable the prosthetic solution can be avoided.

These treatment modalities are all associated with a high cost to the provider and patient (Borum et al 2001).

The costs of dental trauma include emergency services and a variety of specialities such as pedodontics, orthodontics, endodontics or general practice. It also include patient and family out-of-pocket expenses, transport costs, costs due to loss of work and in some cases change in quality of life (Glenor et al 2001)

Most injuries occur in early childhood, whilst the most expensive part of the treatment such as crowns and implants has to await adulthood. Thus the estimation of the total cost of traumatic injuries on a population basis is difficult (Borum et al 2001).

A Swedish study done by Eilert-Petersson et al. (1997) has shown that oral trauma constitutes 10% of all injuries in patients aged 0-19 years seeking health care. Dental trauma is of considerable public health concern. Reducing its effects should therefore be of great long-term value to individuals, society and health care sector.
In Denmark the estimated annual total cost of all treated dental injuries has been reported to be 26.5 millions DKK/year (0.7 mil US$ per mil inhabitants) (Andreasen and Andreasen 1989).

In a report from Norway, the cost of dental trauma for children and adolescents was estimated to be 17.2 million NOK. (0.7 mil US$ per mil inhabitants; Solli at al 1996).

In Sweden, costs of trauma treatment have been calculated to 45 million SEK (0.6 mil US$ per mil inhabitants).

Previous study claims that annual number of individuals with new dental trauma is 25000-30000 in the age interval 0-19 years.

The total cost for the country over a 2-year period, including direct and indirect costs, would then be 90-100 million SEK, and costs of health care service represents 50-60 million SEK. (Glenor et al 2001).

When an orthodontist plans for an early phase of treatment, there should be clear benefits for the patients.

These benefits might include reduced treatment time in the second phase, reduced risk for feature problems, increased stability or reduced costs.

The epidemiologic data indicated that children with excessive overjet are more prone to incisor trauma, and an orthodontist may recommend early treatment to prevent tooth damage by early reduction of large overjet (Koroluk et al 2003). The purpose of this study is to investigate if children who have experienced traumatic injuries to their maxillary incisor teeth have increased overjet, inadequate lip coverage compared to children with no trauma experience or if there was any other difference in the hard and soft tissue variables between dentally traumatized and intact orthodontic patients.
The hypothesis is: children with large overjet and inadequate lip coverage have increased risk for dental trauma.
Material and methods

The data for this study was collected from a public orthodontic clinic in Haninge, a suburb 20 km Southeast of Stockholm. This clinic belongs to the public dental service in Stockholm, operated by the limited company Folk tandvårdens Stockholms län AB. The material for this study was collected from 469 subjects who had their orthodontic treatment between 2002-2005. They were between 7-19 years old at the time they had been initially examined and records taken in the clinic and they have had dental trauma to upper incisors prior to the commencement of their orthodontic treatment. Only subjects born 1st to 10th or 20th to 30th day in month were selected. Their dental records included complete anamnesis, study models, lateral cephalograms, profile photo and frontal photo were lips were relaxed with minimal tension in the perioral musculature.

Out of these 469 subjects, forty-seven subjects with complete records had experience trauma to the maxillary incisors and was considered to represent the “trauma group”.

The diagnosis of previous dental trauma to the permanent incisors at the moment of referral was determined from dental records. It includes a standardized questionnaire, clinical examination, pre treatment study models and photographs.

An age and sex matched references for each of the subjects in the trauma group was selected from the remaining 422 subjects. The age matching was done to a precision of six months.

They had no history of trauma and they had a dental records following the
same criteria as those for the subjects in the trauma group.

Classification of dental trauma.

1. concussion/subluxation
2. fracture of enamel
3. fracture of enamel-dentin without pulp involment.
4. fracture of enamel-dentin with pulp involment or avulsion

In cases of more than one type of injury to the same tooth, only the most serious was registered.

Information about inadequate lip closure was collected from dental journals. If the lips covered the upper incisors in the rest position the lip coverage was considered to be adequate. If the lips failed to cover the upper incisors and the majority of the crown was exposed and clearly visible, the lip coverage was recorded as inadequate.

Overjet was measured on the study models to the nearest 0.5mm.

Overjet was calculated from the labial surface of the mandibles incisors to the incisal edge of the most prominent maxillary incisor, with the ruler being held parallel to the occlusal plane (Burden 1995).

The overjet measurements were divided into four levels following the recommendations of “Index for Orthodontic Treatment Need, IOTN” (Brook and Shaw 1989)

1. overjet 0-3.5mm
2. overjet > 3.5-6mm with complete lip coverage.
3. overjet >3.5-6mm with incomplete lip coverage.
4. overjet 6-9mm
5. overjet >9mm.
The radiographs were taken by different operators. On the X-ray the teeth were in occlusion and the lips were relaxed.

The cephalometric radiographs were analysed using established craniofacial variables assessed by defining cephalometric reference points and planes (Björk 1975). The variables are shown in Fig 1.

The same person traced all the X-rays.

In order to determine the reliability of the method, all radiographs were traced and measured twice.

The intra-observer method errors $S_i$ are calculated using the formula

$$S_i = \sqrt{\frac{\sum d^2}{2n}}$$

where $S_i$ is the combined method error, $d$ is the difference between the first and second measurement and $n$ is the number of double registration (Dahlberg 1940).

For calculating the statistical significance of differences between the trauma and control groups a t-test for independent samples was used.
1. Distance in mm between upper incisors to forehead-chin line
2. Distance in mm between incisors to e-line
3. Distance in mm between upper lip to e-line
4. Distance in mm from spina nasalis anterior to menton
5. Distance in mm from nasion to spina nasalis anterior
Reference points:

(s) Sella: midpoint of sella tursica.

(n) Nasion: the junction of the nasal and frontal bone at the nasofrontal suture.

(A) Downs A-point: the deepest point on the concavity on the anterior maxilla between the anterior nasal spine and alveolar crest

(B) downs B point: the deepest point on the concavity on the anterior mandible between the pogunion and alveolar crest

(m) menton: the lowest point of the on the lower border of the mandibulare symphysis

(sp) Spina nasalis anterior: point of the lower contour of the anterior nasal spine.

References lines:

NSL: line through nasion and sella

NL: maxilla line, line through anterior nasal spina and

ML: mandible line, line trough gnation and lower border of the posterior corpus of the mandible

Ils Incision Superior: a line through the tip of the crown and apex of the upper central incisor

E-line: line through nose tip and the most prominent point on the chin

Forehead-chin line: line through most prominent point on the forehead to most prominent points on the chin
Definition of the angular measurement:

**SNA:** the angle is an expression of the antero-posterior position of point A in relation to the anterior base of the skull.

**SNB:** the SNB angles describes the antero-posterior position of the mandible in relation to the anterior cranial base.

**ANB:** this represent the difference between SNA and SNB angles and defines the mutual relationship, in the sagittal plane, of the maxillary and mandibulare bases.

**NL/ML:** this angle express the degree of the inclination of the mandible in relation to the maxillary base

**Ils/NL:** this angle describes the position of the upper incisors and amount of the proclination.
Results

Trauma involving upper incisors were recorded in 47 of 469 children and adolescence. The frequency for injuries to upper permanent incisors was 10.5 per cent.

In boys, the trauma frequency was 61 per cent, and girls 39 per cent.

This giving a sex ration was 1.6:1.

The fracture of only enamel or enamel-dentin was most common type of dental injuries in boys and girls. (Table 1 and 2)

<table>
<thead>
<tr>
<th>Table 1 Prevalence of traumatic injury to maxillary incisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>diagnos</td>
</tr>
<tr>
<td>Concussion/subluxation</td>
</tr>
<tr>
<td>enamel fracture</td>
</tr>
<tr>
<td>enamel-dentin fracture</td>
</tr>
<tr>
<td>enamel-dentin fracture with pulp involvement</td>
</tr>
</tbody>
</table>

Table 2. Types of dental injury, by overjet, for 47 trauma patients.

<table>
<thead>
<tr>
<th>overjet grade</th>
<th>concussion</th>
<th>enamel</th>
<th>enamel/dentin</th>
<th>pulp involvment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>4</td>
<td></td>
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<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
No statistically significant differences between the trauma group and control group was detected in any of the variables analyzed (Table 3).

<table>
<thead>
<tr>
<th>variable</th>
<th>trauma patients n=47 mean (±SD)</th>
<th>controls n=47 mean (±SD)</th>
<th>difference trauma-controls</th>
<th>statistic significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>overjet</td>
<td>5.5 (2.8)</td>
<td>5.5 (2.9)</td>
<td>0.0</td>
<td>ns</td>
</tr>
<tr>
<td>SNA</td>
<td>83.3 (0)</td>
<td>82.7 (4.1)</td>
<td>0.6</td>
<td>ns</td>
</tr>
<tr>
<td>SNB</td>
<td>79.8 (3.8)</td>
<td>79 (3.7)</td>
<td>0.8</td>
<td>ns</td>
</tr>
<tr>
<td>ANB</td>
<td>3.5 (2.3)</td>
<td>3.5 (2.1)</td>
<td>0.0</td>
<td>ns</td>
</tr>
<tr>
<td>IIs/NL</td>
<td>110 (7.3)</td>
<td>108 (8.4)</td>
<td>2.0</td>
<td>ns</td>
</tr>
<tr>
<td>NL/ML</td>
<td>28.2 (5.5)</td>
<td>27.5 (5.6)</td>
<td>0.7</td>
<td>ns</td>
</tr>
<tr>
<td>inc-forhead</td>
<td>-1.7 (3.9)</td>
<td>-2.6 (4.3)</td>
<td>0.9</td>
<td>ns</td>
</tr>
<tr>
<td>inc-celine</td>
<td>-10.2 (4.2)</td>
<td>-11.9 (3.9)</td>
<td>1.7</td>
<td>ns</td>
</tr>
<tr>
<td>upper lip-eline</td>
<td>-1.6 (2.6)</td>
<td>-1.9 (3.1)</td>
<td>0.3</td>
<td>ns</td>
</tr>
<tr>
<td>nasion-spina</td>
<td>51.8 (4.3)</td>
<td>52 (4.5)</td>
<td>0.2</td>
<td>ns</td>
</tr>
<tr>
<td>spina-menton</td>
<td>70.6 (5.9)</td>
<td>72.1 (6.4)</td>
<td>1.5</td>
<td>ns</td>
</tr>
</tbody>
</table>

*ns: non-significant (t-test for independent samples)*

When categorizing overjet there was a tendency for an increased trauma prevalence in the most severe category (overjet >9mm; Table 4), while for the least severe category (overjet < 3.5mm) the trauma prevalence was slightly lower.

<table>
<thead>
<tr>
<th>categories of overjet</th>
<th>trauma patients</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3.5mm</td>
<td>17 (36.5%)</td>
<td>25 (53%)</td>
</tr>
<tr>
<td>&gt;3.5-6mm with adequate lip coverage</td>
<td>7 (15%)</td>
<td>7 (15%)</td>
</tr>
<tr>
<td>&gt;3.5-6mm with inadequate lip coverage</td>
<td>4 (8.5%)</td>
<td>4 (8.5%)</td>
</tr>
<tr>
<td>&gt;6-9mm</td>
<td>10 (21%)</td>
<td>7 (15%)</td>
</tr>
<tr>
<td>&gt;9mm</td>
<td>9 (19%)</td>
<td>4 (8.5%)</td>
</tr>
</tbody>
</table>

The results showed that patient and controls with increased overjet are more prone to have incompetent lip coverage, than patients and controls with normal overjet.
Discussion

Large discrepancies exist in reports on the prevalence of incisors trauma. Reported prevalence range from less than 6% (Burton et al 1985) to nearly 40% (Hamilton et al 1997). The prevalence rate of the present study was 10.5%. The great variation may be due to a number of different factors such as the trauma classification, the dentition studied, geographical and behavioural differences between study locations and countries.

Forsberg and Tedenstam (1990) observed a relatively high prevalence of traumatised teeth in children aged 7-15 years. 30 per cent of 483 children had experienced dental injuries, but this study included primary teeth and mandibulare incisors. Kaba and Marechaux (1989) observed a prevalence of trauma to permanent incisors in children of 11 per cent. Dearing (1984) found that 18.8 per cent of children between 7.5 years and 15 years had suffered fractures of the maxillary incisors. The mean incisal overjet of fractured incisors was 6.4mm and it was significantly different between the controls and patients. The mean overjet in our study was 5.5mm and there was no significantly difference between controls and traumatized patients. Our study included not only fractured teeth, but also injuries to supporting tissues. Comparison of the prevalence of traumatic injuries found in this survey with previous studies is difficult because of differing criteria used to register traumatic injury and the different age groups. Assembly, the prevalence of
traumatized incisors should be higher in this sample since it comprises patients with malocclusions of varying severity, who had been referred to an orthodontic clinic for treatment. One of the main indications for providing subsidized orthodontic treatment according to the Swedish model is the increased risk of trauma in subjects expressing an increased overjet. It is to be expected that those subjects were overrepresented in our sample compared to an unselected sample.

Several of the records had an incomplete history of accident concerned or there was no study models or cephalograms. Those records were excluded from the study.

Boys seemed to be more prone to traumatic dental injuries than girls. this is in agreement with other studies (Bauss 2004, Forsberg 1993). The sex difference may be related to different indoor and outdoor activities. This might be explained by observations that boys in general participate in more strenuous activities with higher trauma risk, such as contact sports and more aggressive types of play, and by the observation of delayed maturation rates in males (Kania et al 1996).

Another important factor found to increase the risk of dental trauma while playing sports was the lack of a mouth guard or faceguard (Chapman 1996, Rodd 1997)

Jolly et al, 1996 observed that when a mouth guard was not worn during football games, the likelihood of a fractured or avulsed tooth was at least twice that of when a mouth guard was worn.

O’Mullane (1973) found only seven cases of dental trauma among 448 boys who took part in organised sporting activities, and suggested that the use of
mouth guard might have contributed to this low frequency. This may indicate that boys require more treatment than girls. But Glenor et al (2001) showed that if a child or an adolescent have suffered dental trauma, the trauma *per se* is of more importance to cost than gender, even if boys have a higher incidence of dental trauma and thus engage in riskier behaviour than girls.

Our findings suggest that most the common type of trauma in maxillary incisors is involving only enamel or enamel and dentin. This is in agreement with earlier studies (Oikarinen 1987, Forsberg 1990, Bauss 2004). Only nine of forty-seven trauma patients had overjet larger than 9mm. (19 per cent). If study included larger number of trauma patients the amount would be higher.

The most remarkable result in the present study is that an increased overjet and inadequate lip coverage could not be attributed to an increased risk for traumatic injuries. This finding contrasts a number of earlier studies. Relationship between traumatic injuries to anterior permanent teeth and amount of overjet as well as lip coverage has been discussed by various authors (Soriano 2004, Buren 1995, Forsberg 1993, Järvinen 1977).

To reduce the risk for trauma, these studies have been used as a foundation for recommending orthodontic treatment at an early stage in individuals who tend to develop large overjet and / or insufficient lip coverage of the maxillary incisors. However, it is not possible to determine whether early orthodontic treatment is an efficacious approach to reduce the risk of incisor injury, because the most sensitive period for injuries is long before the child has achieved a proper age for orthodontic intervention.
In line with the results of the present study Stokes et al (1995) in a case control study did not found any statistic difference between anterior overjet and dental trauma in Singapore schoolchildren. This study of revealed an extremely low prevalence of injury compared to this study. Of 11 179 children, only 49 were recorded as having suffered dental trauma of any type. The prevalence is 0.33 per cent compared to our study 10.5 per cent. Also Hunter et al (1990) did not observe an increases frequency of dental trauma with incompetent lip coverage.

How to explain the seemingly contradictory results of this study?
The reason might partly be due to the overall low prevalence of traumatic dental injury compared to the studies based on children born 1960-1980.

The lifestyle of children and adolescence have undergone a tremendous changed over the last few years. Children are less active than before. Outdoor physical activities has been substituted by consumption of films, videogames and sustained use of computers. Thus children are nowadays much less exposed to conditions predisposing to trauma.

A physically inactive lifestyle is one of the main factors contributing to the sudden increase in the proportion of obese children.

A recent survey shows that about 20 per cent of Swedish adolescents are overweight or obese (Marcus et al 2004).

The prevalence of obesity in children is emphasized by the results of an epidemiological study which shows a clear upward trend in body weight that is equivalent to 0.2kg increase in body weight/year at any given age. (Freedman et al.1997).

Craniofacial growth is dependent on interactions between genes, hormones,
nutrients and epigenetic factors. Disturbance of any of these mechanisms may result in an aberrant growth pattern. (Öhrn et al. 2002).

Craniofacial morphology differs between obese and normal adolescents. In general obesity was associated with bimaxillary prognathism and relatively larger facial dimensions. (Sadeghianrizi et al. 2005).

Öhrn et al (2002) have found that obese adolescents have increased mandibular length, prognathic jaws and a reduced upper anterior face height.

In this respect information about body mass index in relation to dental trauma would be of paramount interest.

So far possible association between body mass index and occurrence of dental trauma has been addressed in only few studies. Nicolau et al (2001) have shown in 13 years old Brazilian children that obese boys belonging to a non-nuclear family have an increased the risk of having traumatic dental injuries.

Petti et al(1997) showed that obesity significantly increased the risk of traumatic injury. The injury prevalence of obese and non-obese children was 31.8% and 20.0% respectively and it was high significant difference. One of the reason explaining this result was that the obese children of this sample were less active than the other children and that an active lifestyle resulted in being trauma-protective.

The similarity of the skeletal profile in the trauma and control groups was noteworthy. Lack of difference may be due to the sampling method. The subjects in both groups were orthodontic patients, and had some form of skeletal and dental malocclusion.
Conclusion

The prevalence of dental injuries to upper incisors was 10.5 per cent. The boys were effected more than girls. No statistically significant differences between the trauma group and control group was detected in any of the variables analyzed.

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