Causes and Prevalence of Traumatic Injuries to the Permanent Incisors of School Children aged 10-14 years in Maseru, Lesotho

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science (Dent), Department of Community Oral Health, Faculty of Dentistry, University of Western Cape.

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KEY WORDS

Dental trauma,

Causes of dental injury,

Incisal over jet.

ABSTRACT

The aim of this study was to investigate the prevalence, etiology and types of injuries to permanent incisors among schoolchildren aged 10-14 years from Maseru, Lesotho.

A cross-sectional survey was carried out. One dentist (HL) carried out all dental examinations.

Upper and lower permanent incisors were examined for dental injuries. The prevalence of traumatic injuries to the permanent incisor teeth was 9.3 % (13.3% boys, and 6.3% girls). Significantly more boys than girls suffered injury. The most common type of injury was enamel fracture and most common causes of injury were falls. Children with incisal over jet greater than 5mm and inadequate lip coverage were not more likely to have experienced dental injuries.

Health promotion policies should aim to create an appropriate and safe environment. Soft playground surfaces, school-crossing patrols, marked zebra crossings and bicycles lanes would help create a safe environment. Speed limits for cars, the use of seat belts, air bags, special car seats for children and bicycle helmets should be enforced. Mouth guards should be used when playing sport, in particular contact sports.

Education regarding the epidemiology of dental injuries and its prevention through health promotion may play a major role in reducing the prevalence of dental injury and avoiding the financial costs of treatment, especially in developing countries.

DECLARATION

I, Dr.Htein Lin,

hereby declare that the work contained in this thesis is my own original work and has not previously, in its entirety, or in part, been submitted at any university for a degree.

Full name: DR. HTEIN LIN

Signature:

Date: March, 2006

DEDICATION

Affectionately Dedicated To My Parents,

My Wife and Children

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To all those who were not mentioned, but played significant roles in making this survey a success, thanks all of you for making this process a memorable and historic occasion.

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Causes and Prevalence of Traumatic Injuries to the Permanent Incisors of School Children Aged 10-14 Years in Maseru, Lesotho

CHAPTER 1: INTRODUCTION

Dental services have traditionally been concerned with treating and, to a lesser extent, preventing two major diseases - caries and periodontal disease. Nowadays dentistry has a more preventive and promotive focus in many countries. Such a trend is to be encouraged as global problems of oral disease will never be adequately controlled by reparative treatment alone. With the decrease in prevalence of caries and periodontal disease, dental public health for children has come to the fore; prevention and promotive care for traumatic dental injuries and other oral mucosal lesions(oral cancer, oral candidiasis etc;)

Traumatic dental injuries are widespread in the population and the prevalence of traumatic dental injuries among school children in different parts of the world varies from a low of 2.6% (Macko et al.1979), to a high of 43.8 % (Marcenes and Murray, 2001). Most of the traumatic dental injuries involve the anterior teeth, which may lead to eating restrictions, changes in physical appearance, speech defects and psychological impacts, that affect the child's quality of life. Thus dental trauma is of considerable public health importance. The treatment for dental trauma varies from simple composite fillings to endodontic treatment, crowns, capping and/or the replacement of missing teeth. These costs are often more than treating dental carries among children. In Denmark, the estimated annual total cost for treating these injuries in children and adolescents has to be 25 million SEK (Andreasen, 1989).

Solli (1996) reported that in Norway the total cost of treating dental trauma in children and adolescents is 18 million SEK (*1$=9.17 SEK, in 2000). In UK, the average cost for treating a patient with a traumatic incisor would be £856 (O'Brien 1993). Thus, the prevention of dental trauma through health education and health promotion may play a major role in reducing damage to teeth and avoiding the financial costs of treatment.

Children with dental and maxillofacial trauma are often neglected in developing countries. There is a paucity of literature on the prevalence of traumatic injuries to the incisor teeth of children in both developed and developing countries especially when compared to the data available on dental caries and periodontal disease. Information on prevalence and severity of dental trauma in various age groups of the population has significant implications for the planning of public oral health care preventive and other strategies for the population. There is no report on the prevalence, analysis of risk factors of traumatic injuries to the incisor teeth of school children in Maseru (Lesotho). There is therefore a need to assess the prevalence of dental trauma, the risk factors associated with these injuries, and the impact and consequences of these injuries.

Country Profile

Lesotho lies between latitudes 28 and 31 south and longitudes 27 and 30 east. Modern Lesotho, is an enclave surrounded by the Republic of South Africa, lying entirely outside the tropics. This, together with the fact that all its land is at least 1400 metres above sea-level, means that Lesotho is free from the tropical diseases which are a major problem in

almost all other African countries. The area of Lesotho is roughly 30,300sq km and the country has a population of approximately 2.2 million that is growing at a rate of 2.6% annually. Sixteen per cent of the population is under the age of five and 50.3% under 20 years. Most of the towns including the capital city, Maseru, are situated in the densely populated western lowland region. A substantial percentage of the population (about 80%) live in rural areas in family compounds made up of one family extending over several generations. Poverty and unemployment are high. The general health coverage is good, while the oral health coverage poor. As in other developing countries, dental caries, periodontal disease and fluorosis prevalence are of moderate to high levels.

Economy

Lesotho's economy is tightly linked to that of South Africa. The country is part of the Rand Monetary Area and its currency is on par with the Rand. Hence, any change in exchange rates or inflation in South Africa directly affects Lesotho. Remittances from mineworkers in South Africa account for 37% of GNP. Thus, the country is heavily dependent on migrant labor, its principal resource is its people. Lesotho's economic wellbeing therefore comes mainly from miners remittances from South Africa, favorable weather conditions, and domestic investment like the Lesotho Highland Water Project (LHWP).

Oral Health Policy

Lesotho's vision for health and social welfare is contained in the general policy principles and objectives of the global Health for All (HFA) strategy, which recognizes Primary Health Care (PHC) as the approach to implement such a strategy. The Ministry seeks to provide an efficient and compassionate health care and social welfare system with particular emphasis on prevention and eradication of priority health and social problems through cost-effective interventions.

Oral health is linked to the PHC Department through the Health Education Division. The first oral health conference in Lesotho was held in April 1999 and served as a springboard to a variety of oral health activities geared towards improving oral health in Lesotho. Findings from this conference revealed that the main constraint to better health provision is the shortage of appropriately trained oral health personnel in all levels of the health care system. There are a total of 18 dental surgeons in Lesotho none of whom have specialist qualifications; 14 are working in the public sector and 4 are in private practice. This gives a dental operator/population ratio of about 1:61,000

The national oral health policy and its sustainability are guided by the following principles:

1. High priority to promotion of oral health and prevention of oral diseases.
2. Focus of oral health interventions on the district and its communities with particular emphasis on children, pregnant women and other vulnerable groups.

3. Use of only interventions which have proven efficacy.

4. Integration of oral health activities in all primary health care programmes.

5. Participation of communities in oral health activities that affect them.

Background of the study

Studies carried out in industrialized countries showed a relatively high prevalence of dental trauma. Andreasen (1984) collected data from 14 prevalence studies carried out in industrialized countries. Prevalence ranged from 4% to 30%, most being close to 10%. Andreasen (1994) concluded that the studies may have underestimated the occurrence of dental trauma.

In addition, dental trauma treatment has been neglected. The prevalence of untreated damage of the teeth for both genders and all ages in the United Kingdom (UK) is higher than 80%. The prevalence of dental trauma is related to age and gender. In the UK, the prevalence of accidental damage among children aged 8 years is 10%, rising to 26% at the age of 15 years. As expected, dental trauma is more common among boys than among girls. The main causes of dental trauma are accidents, which is also the main causes of death among children in industrialized countries. In the United States, accidents are the leading single cause of childhood mortality (Holmes and Reyes, 1984). The rate of episodes of persons injured per 100 persons per year in 1992 in the United States was 23.

Each year in England around 4,000 people die and more than 2.5 million require medical attention following home accidents. Road accidents account for the deaths of more than a further 4,000 people, including about a quarter of all deaths among school-children (The Health of the Nation). It is well known that prevention plays a major role in reducing accidental damage of the teeth. Most importantly, prevention of dental trauma will reduce all types of injuries and mortality due to accidents. Therefore, it is very important to assess not only the prevalence of accidental damage of the teeth but also to elucidate its causes.

CHAPTER 2: LITERATURE REVIEW

The governments of developed nations increasingly accepted that spending more money on health services will have only a limited impact. Even though the investment in health services has steadily increased, the mortality and morbidity statistics have remained inversely related to socio-economic status. Governments have now turned their attention to cost containment (Green and Kreuter, 1990), and of finding ways to reduce and stabilise costs, while continuing to secure improvements in health. At the same time it has been recognised that many major health problems can be prevented by changes in personal behaviors or the social and physical environment in which people live. This has provided the first step in the development of a new approach to the health of the entire population, that of prevention and health promotion (Granath et al, 1986).

Oral health is an integral part of general heath: no individual can be considered fully healthy while there is active disease present in the mouth. Oral diseases can have indirect effects on the health and contribute toward loss of productivity at work and school. It therefore makes sense that they be prevented. In some countries where the incidence of dental caries is declining, dental trauma has become a major oral health issue among children and teenagers, and prevention methods are being investigated in an attempt to control the incidence of this type of injury.

Dental trauma is an irreversible pathology and may cause life-long debilitating effects. Unrestored crown fractures in young adolescents might be a challenge, and may affect their quality of life. In many countries, dental trauma is considered a greater threat to the health and preservation of anterior teeth, than caries. The epidemiology of dental trauma shows, at least in some countries, that nearly every second child will suffer a traumatic injury before the age of 12. For example, in Sweden, Eilert-Peterson et al. (1997) reported that oral trauma constitutes 10% of all injuries in patients aged 0-19 years seeking health care. The 1993 Children's Dental Health Survey in the UK (O'Brien 1993) showed that one in five children experienced dental injuries to their permanent anterior teeth before leaving school.

Prevalence

The prevalence of traumatic dental injuries among school children have been reported by many authors, and the prevalence of injured teeth in different parts of the world and varies from a low of 2.6% (Macko et al. 1979) to a high of 43% (Marcenes et al. 2001). The analysis of epidemiological studies shows that prevalence varies significantly, and this may be due to the variability of criteria according to which dental trauma is measured. The variation perceived has been associated with a series of factors: trauma classifications, type of dentition, geographical and lifestyle difference in the studied populations and the access to health services for evaluation and treatment purposes, all of which, by themselves or combined, make data comparison a difficult task (Andreasen et al 1990).

There is no doubt that traumatic dental injuries nowadays still present a high prevalence especially in young people. Andreasen et al (1994) pointed out that the prevalence of dental trauma is higher than that normally reported in epidemiological surveys, because cross section studies tend to underestimate its occurrence when simplified classifications are used, and only trauma in the internal structure of the mouth is described, disregarding alveolar socket injuries or maxillary and mandibular fractures.

The management of traumatic dental injuries

Traumatic injuries of permanent incisors and their supporting structures require immediate assessment and management, because many permanent teeth continue their development in the younger age groups. The management of the dental traumatic injuries is often a challenge to the dentist and may involve a lengthy treatment plan including apexification of immature apex or management of progressive resorption. Wong (2004) reported that dental trauma patients had to attend 3 to 27 visits for treatment. The median was eight visits and 25% of the patients had to attend more than 14 visits. The mean treatment time was 24.6 months and the treatment duration for 25% of the patients was longer than 36 months. Thus, treating dental injuries is a complex problem in the management of health care in children and adolescents because their parents, carers and sometimes the entire family may be involved.

The damage caused by trauma on the hard and soft tissue of the mouth can be minimized with accuracy in diagnosis and treatments performed without losing time. Thus, careful diagnosis and periodic check-ups are necessary in all dental trauma cases.

Cost of treatment

The treatment for dental trauma varies from simple composite fillings to endodontic treatment, crowns, capping and/or the replacement of missing teeth. These costs are often more than treating dental caries among children. Total costs include direct and indirect costs.

Direct costs

Costs to the health care services

- Costs within the health care services include costs of health care professionals, other labour, capital costs and supplies.

Costs due to loss of personal property and cost of medicine

- The cost of damaged personal property and cost of medicine when prescribed.

Transport costs

- Transport costs include costs for the companions. The transportation provided by the parents or other professional or non-professional companions (accompanying the patient for care), and costs are calculated according to distance using a private cars or a taxi cabs.

Indirect costs

Costs due to loss of production or leisure

The degree of severity of the injury will have an impact on direct and indirect costs for both patients and companions, and access to dental treatment will impact on indirect costs to the companions. Traffic settings increases the costs for the patients, and the involvement of emergency or public health centres or treatment by special dentists will have a variety of impacts on costs to both patients and companions (Glendor-2001).

Glendor (2001) reported that in Sweden, the annual number of individuals with new dental trauma was between 25 000 and 30 000, in children and adolescents aged 0-19 years. The total costs for the country of these new dental trauma cases, over a 2 year period, including direct and indirect costs, was estimated to be 90-110 million SEK, whereas the costs of health care services for the treatment of traumatic injuries represents 50-60 million SEK. (*1$=9.17 SEK, in 2000). The average total cost per patient, including the average number of companions at traumas to permanent and primary teeth, was 4 569SEK and 1 746SEK respectively. Direct costs, due to health care service, transport, loss of personal property and medicine, represented 72% of the total cost for permanent and 60% for primary teeth, whereas transport costs represented only 5% and 12%, respectively. The average total costs at the emergency visit represented 27% and 45% of all visits for trauma to permanent and primary teeth, respectively.

The average cost for treating a patient with a traumatised incisor in UK was estimated to be £856 using the median of eight visits per patient. This estimation did not include traveling cost and other expenses that the parent/carer might incur due to the absence in work or at home (Wong 2004). Andreasen (1989) reported that, in Denmark, the estimated annual total cost of all dental traumas to society has to be 226 million SEK*, and the cost of treating these injuries in children and adolescents to be 25 million SEK. Corresponding figures in Norway for children and adolescents has been calculated at 18 million SEK (Solli et al. 1996). (*1$=9.17 SEK, in 2000). The costs of dental trauma also includes patient and family out-of-pocket expenses, transport costs, costs due to loss of work etc. Priorities must be based on a systematic knowledge of the effects of treating dental trauma to reduce direct and indirect costs.

Localization of dental trauma

The central maxillary incisors were the teeth most frequently injured. Hamdan (1995) reported figures of 70.4%, Nick-Hussein (2001) 78%, Saroglu (2002) 86%, Cortes (2001) 81%, and Hargreaves (1995) 84% of the cases involved the maxillary central incisors. The results of which were consistent with those of a number of previous studies. Most of the authors reported that both left and right maxillary central incisors were equally affected.

Gender-based differences

In most studies, dental trauma occurred more frequently in a single tooth than in several teeth and enamel fracture was the most common type of injury. Many studies in the literature show that boys suffer injuries to their permanent teeth more often than girls. From an epidemiological point of view, most authors suggest an association between male gender and dental trauma, attributing this difference to their more intense participation in contact sports, behavioural differences, car accidents, teasing during everyday outdoor activities and fights (Artun et al, 2005; Grimm et al, 2004) An exception to this epidemiological consensus was suggested by Zadik (1976) and Garcia-Godoy (1984) who did not find significant gender-based differences in their studies.

Classification of trauma

Traumatic dental injuries have been classified in various ways (Ellis et al. 1970; Johnson 1981, Andreasen 1994), some of which are described below. Fried (1995) reported an easy and accepted classification of dental injuries as: (i) trauma affecting the tooth (hard tissues); (ii) trauma affecting the periodontium. A combination of sub classifications may occur following a traumatic accident.

Andreasen's classification (1994)

1: Fracture of enamel, including enamel chipping.

2: Fracture of enamel-dentin without pulpal involvement

3: Fracture of enamel-dentin with pulpal involvement;

4: Fracture of root;

5: Crown – root fracture without pulpal involvement;

6: Crown – root fracture with pulpal involvement;

7: Concussion;

8: Subluxation;

9: Intrusive luxation;

10: Extrusive luxation;

11: Lateral luxation;

12: Avulsion.

Modification of the Ellis Classification (Fried-1995)

Classification of Hard Tissue Fractures:

Class I Simple fracture of enamel only

Class II Fracture includes enamel and dentine

Class III Fracture includes enamel, dentine and small pulpal exposure

Class IV Fracture involves a significant amount of pulpal exposure

Class V Fracture involves complete loss of tooth (avulsion)

Class VI A root fracture

Classification of tooth trauma affecting the periodontium:

- **Concussion** is defined as sensitivity of the tooth due to trauma without abnormal loosening or mobility. The tooth may be sensitive to percussion following the trauma.
- **Subluxation** is defined as the loosening of the tooth (mobility) without displacement.
- **Luxation** is defined as the displacement of a traumatized tooth. It can occur in a variety of direction including labially, palatolingually, mesially, distally, by extrusion, or any combination of two or more. Crushing of the alveolar socket may occur in any case.
- **Avulsion** is a complete displacement of the tooth from its socket.
- In severe trauma, with excessive force, alveolar fracture may be associated with tooth displacement.

The classification of Ellis modified by Holland et al. (1988) as follows:

Class 1: Fracture of enamel only

Class 2: Fracture includes enamel and dentine, without pulp involvement.

Class 3: Fracture of enamel and dentine with pulp involvement.

Class 4: Discolouration of the tooth as a result of concussion to the tooth, with or without a sinus.

Class 5: Displacement; extrusion, intrusion, and lateral displacement.

Class 6: Tooth loss as a result of trauma.

Class 7: Tooth restored by composite or crown following fracture.

Garcia-Godoy et al. (1985) suggested that careful attention should be paid when analyzing data on the types of injury described, as this can vary according to the place where the study is conducted. In retrospective studies, some injuries could have missed being recorded as they may only have been reported if clinical signs and/or symptoms (such as concussion, intrusions, extrusions and luxations), were present at the time of the examination. In prospective studies, injuries will be only recorded if the patient seeks dental care, which rarely happens if the traumatic dental injury was mild (concussion, enamel fractures and some enamel – dentine fractures). Most studies reported that enamel fractures were the most common type of trauma.

Predisposing factors

Increased overjet and inadequate lip coverage

Well known predisposing factors of dental trauma are large maxillary over jet or protruding incisors and incompetent lips coverage ((Nicolau et al. 2001; Cortes et al. 2001; Marcenes et al. 1999). However, in one report, Marcenes et al (2000) found no relationship between an increased overjet and increased susceptibility of injury.

Overcrowded households

Marcenes et al. (2002) reported that overcrowded households were statistically significantly related to the occurrence of dental traumatic injuries.

Obesity

Nicolau et al. (2001) reported that overweight children were 1.93 times more likely to have dental injuries than normal weight children, but Soriano et al (2004) found no correlation between traumatic dental injuries and obesity. These differing results may be due to the different methods used to measure body mass index (BMI) and the National Centre for Health Statistics (NCHS) obesity index.

Socio-economic condition

There have been a few studies that address the relationship between dental trauma and socio-economic conditions, and the results are conflicting. Hamilton et al (1997) observed that children of lower socio-economic level were more prone to present with

traumatic injuries if compared to the children of higher socio-economic level. Cortes et al (2001), found a higher prevalence of dental trauma among the children included in the highest socio-economic level. Marcenes et al (2001) showed that in the UK, prevalence of dental trauma was higher in Newham (23.7%), the poorest socio-economic area of London than in other areas of the UK. Further studies comparing dental trauma and socio-economic status are necessary to establish a more conclusive association.

Causes

Most of the authors reported accidental falls as the main cause of injuries to the permanent incisors (Soriano et al 2004, Marcenes et al, 2000; Hamdan et al, 1995; Saroglu et al, 2002; Hargreaves et al,1995), but an earlier by Marcenes et al (1999) reported that violence (42.5%) was the most common cause of injury. Other causes reported were road traffic accidents, collisions and sport injuries.

Preventive measures

Most traumatic dental injuries present with uncomplicated crown fractures, but other injuries may be more serious and require complex treatments like root canal treatment (RCT) and crowns and these treatments may cost more than that for treating dental caries. Untreated dental injury imposes a physical and psychological trauma to the children (Marcenes, 2001). Prevention through health education and health promotion may play a major role in reducing damage to teeth and avoiding the financial costs of treatment.

Health promotion policies should aim to create an appropriate and safe environment. Soft playground surface, school-crossing patrol, marked zebra crossing and bicycles lanes would help create a safe environment. Speed limits for cars, use of seat belt, air bags, special car seat for children and bicycle helmets should be enforced. Mouth guards should be used when playing sports, in particular contact sports.

Petti (1996) suggested that supervising dental occlusion development and starting an orthodontic therapy at an early stage should be considered in subjects with physical predisposing factors. Oral health education programmes should be taught to the parents, teachers, health care workers and those who are likely to be involved in an emergency, the correct management of damaged teeth, to prevent further damage, such as tooth loss.

CHAPTER 3: AIM AND OBJECTIVES

Aim

To assess the prevalence and causes of traumatic injuries to permanent incisors of 10-14 year old school children in Maseru.

Objectives

- To determine the prevalence of traumatic injuries to permanent incisor teeth in 10-14 year old children.
- To determine the causes of traumatic injuries to permanent incisor teeth in 10-14 year old children.
- To make recommendations regarding the prevention of traumatic injuries associated with this cohort of children.

CHAPTER 4: MATERIALS AND METHODS

This study was a cross sectional study of a quantitative nature. Children aged 10 to 14 years from both the public and private schools in Maseru, Lesotho formed the study population. The protocol was approved by the Research Ethics Committee of the University of Western Cape and local authorities (Ministry of Education and Ministry of Health). These letters of approval from the Ministry of Education were sent to the principals and head teachers of the randomly selected schools informing them of the survey schedule and asking them for their permission and co-operation.

A letter was sent to the parents of the randomly selected children explaining the study aims and objectives, the importance of the study, and asking for permission for their child to participate in the proposed study. These children were randomly selected to represent the population of 10-14 year old school children living in Maseru.

The size of the sample was calculated to give a standard error of 5% or less. The 95% confidence interval level and a prevalence of dental injury of 15% were used for the calculation. The following equation was used to work out the required sample size.

$$n = \frac{p \times q}{(E/1.96)^2}$$

n is the minimum sample size required

p is maximum expected prevalence rate(%)

$q = 100 - p$

E is the margin of sampling error tolerated (%)

Sample size

290 children agreed to participate in this study. This number was more than the minimum sample requirement.

4.1. DENTAL EXAMINATION

Children who agreed to participate in the study were examined at the schools during class hours, in a predetermined timetable, as arranged with the school principals. They were examined at their desks in the classroom.

The instruments and material needed were packed and sterilized in sufficient quantities for each work day (WHO, Oral Health Surveys - Basic Methods, 1997). The sets of instruments and supplies used were as follows: plane mouth mirror, periodontal probe, gloves, and gauze pads. To get the standard light source, a spot head light was used by the investigator. Periodontal probes were used for removing debris, assisting in identifying the presence and extent of restorations and for measuring the size of over jet.

The examiner made a systematic approach to the examination for accidental damage of the teeth, proceeding in an orderly manner from one tooth or tooth space to the adjacent one. The dental examination included only upper and lower incisors. A numerical coding system was used for recording the type of accidental damage of each tooth.

The following clinical data were collected:

4.1.1. Dental trauma

The presence of a treated or untreated damage of the tooth was taken into account to calculate the prevalence of dental trauma such as presence of fractures, discoloration, fistulous tract, missing teeth, restorations and denture provided. All the signs were taken into account that related to reported traumatic injuries to the tooth or teeth.

4.1.2. Damage to the tooth/teeth

The type of accidental damage that was recorded included: fractures, discolouration, fistulous tract and missing teeth due to trauma. The investigator asked the participants whether or not the sign(s) are related to an accident experience.

Traumatic damage may result in soft tissue injuries and or hard tissue (teeth) injuries. Soft tissue injuries such as luxation, concussion and intruded teeth may heal without leaving any evidence, thus, at the time of survey the soft tissue injuries were not always recorded. In addition, vitality tests and radiographic examinations were not carried out and root factures, therefore, were not recorded. To record the tooth injury, the classification of Ellis (Ellis et al 1970), as modified by Holland (Holland et al 1998) was used:

Class 1: Fracture of enamel only.

Class 2: Fracture of enamel and dentine, without pulp involvement.

Class 3: Fracture of enamel and dentine with pulp involvement.

Class 4: Discolorations of the tooth, with or without a sinus.

Class 5: Displacement, extrusion, intrusion, and lateral displacement.

Class 6: Tooth loss as a result of trauma.

Class 7: Tooth restored by composite or crown following fracture.

4.1.3 Treatment provided and needed

The type of treatment and the type of treatment need were recorded. The types of treatments recorded included acid etch restorations, permanent crowns and dentures due to dental trauma. The type of treatment needs that were recorded included acid etch restoration, permanent crown, denture due to trauma and bleaching.

Endodontic treatment could not be recorded, and endodontic treatment need was calculated based on the presence of discoloration, fistulous tract and fracture with pulp exposure.

4.1.4. Overjet

Overjet was measured: The horizontal relation of the incisors was measured with the teeth in centric occlusion. Only the largest maxillary overjet (from the labial-incisal edge of the most prominent upper incisor to the labial surface of the corresponding lower incisor) was recorded. A CPITN periodontal probe was used. The measurement was done holding the instrument parallel to the occlusal plane. The children were separated into different groups according to overjet of less than 5mm and 5mm or more. This trait was not recorded where there was a loss of upper incisors or if a lingual crossbite was present.

4.1.5. Lip coverage

To record lip pattern, each child was instructed to stand in a specified position and the lip line carefully observed. If in the rest position, the incisors were covered completely by the lips, the lip coverage was scored adequate, otherwise an inadequate score was recorded.

4.2 Interview

After the dental examination, children who experienced dental trauma were asked about its aetiology (Appendix 1). Enamel fractures were most common type of injuries reported (77.8%) and because of slight damage some children were not able to remember every detail of the accident and when they happened. In these situations, the parents were contacted to try and elicit further information.

The following data were collected during the interview:

4.2.1. Time of the accident

In order to have more precise information about the prevalence of accidental damage to the teeth according to age, children and parents were asked when the accident that caused the dental trauma occurred.

4.2.2. Type of accident

The following causes of trauma are commonly reported: accidental falls, bicycle falls, traffic accidents, collision against objects and violence. Since "accidental falls" is a broad category, specific questions were asked about the falls such as whether the fall was from a window, stairs, playground equipment, or from being from pushed or tripping.

4.2.3 Place of the accident

The children were asked where the accident happened (home, school, street, club or park).

4.2.4 Characteristics of the physical environment

Details about the places where the accident occurred were also recorded (i.e. swimming pool, playground, sports field, etc). For more detail, children and parents were asked to describe the place where the accident occurred, specifying surface type, products and equipment involved.

4.3 PILOT STUDY

A pilot study was carried out with a sub-sample (n=10) for the amount of time each examination took, the dental examination procedures and to test the data capture sheet format. These children were excluded from the larger study sample.

4.4 DATA TRANSFER AND DATA ANALYSIS

Data was coded and entered onto a PC. Data analysis included descriptive statistics (frequency distribution and cross-tabulation). The prevalence of accidental damage to teeth by age and gender were calculated. The prevalence of different clinical damage due to accident, the treatment provided and treatment needs were also computed. The computer programme "Statistical Package for Social Sciences" (SPSS) was used.

CHAPTER 5: RESULTS

Prevalence

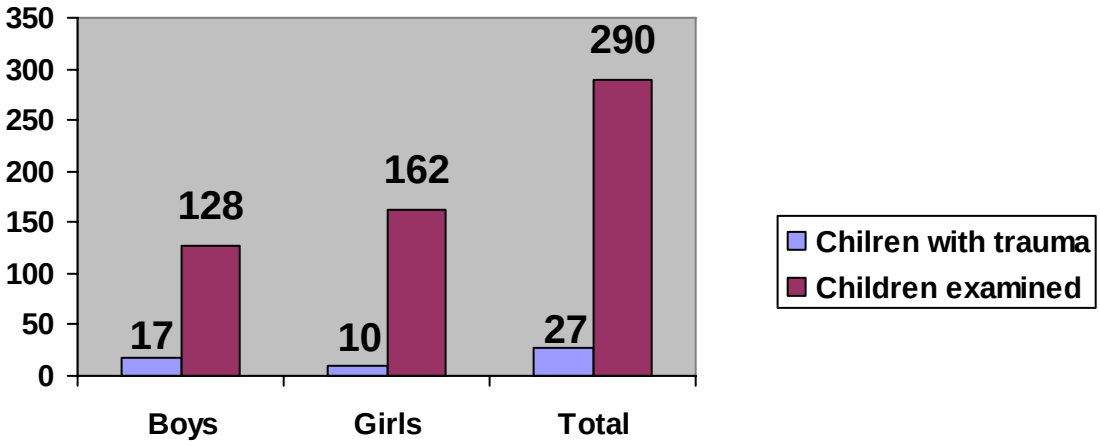
Of the 290 children examined, 27 children had traumatized permanent incisor teeth. The prevalence was 9.31%, with 13.3% in boys and 6.2% in girls. A significant difference was found, showing positive association between the male gender and prevalence of dental trauma. The ratio between boys and girls was approximately 2:1; this difference was also statistically significant. The number and proportion of children who had traumatized permanent incisors are presented in Table 1.

Table 1: The number and proportion of child with traumatized incisor tooth.

Gender	**Boys**	**Girls**	**Total**
Number of child examined	128	162	290
Number and % with injuries	17(13.28%)	10(6.17%)	27(9.31%)

Mean prevalence rate = 9.31%

Fig 1: Number of children with traumatized incisor teeth.



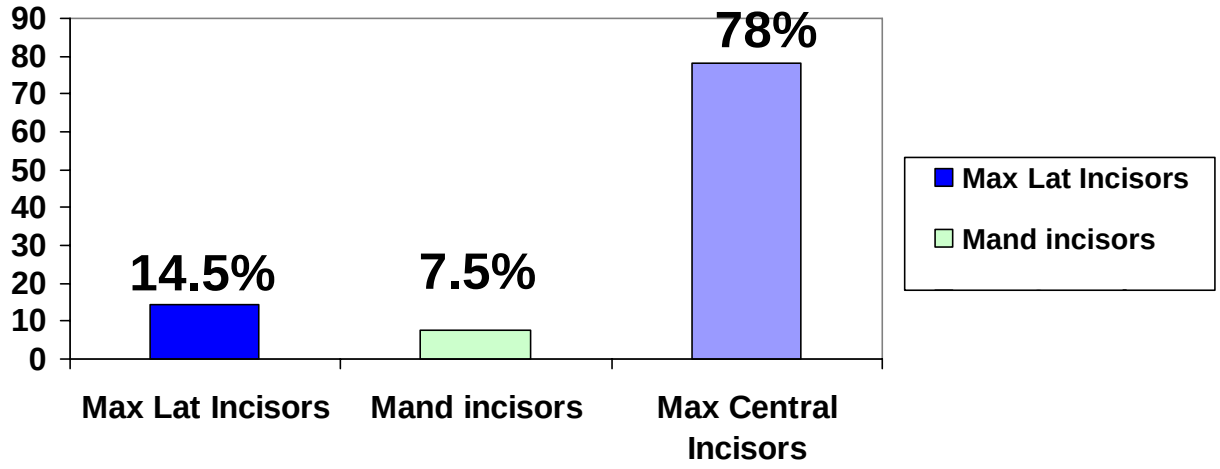
Trauma location

All 27 traumatized teeth were found in the incisor teeth: 92.5 % were maxillary teeth and the remainder, 7.5 % in the mandibular teeth. Maxillary incisors are usually the most affected teeth from dental trauma, due to their protrusive and vulnerable position. Of the maxillary teeth, the central incisors were most affected (n=21; 77.8%); 8 (29.6%) occurred on the right central incisor and 13 (48.15%) on the left central incisor.

Table 2: Localization of trauma

Injured incisor tooth	No. of injuries	% Trauma
11	8	29.60
12	1	3.70
21	13	48.15
22	3	11.11
31	1	3.70
41	1	3.70

Fig 2: Locality of trauma



Types of trauma

The classification of Ellis modified by Holland was used to record the type of trauma:

Class 1: Fracture of enamel only

Class 2: Fracture includes enamel and dentine, without pulp involvement.

Class 3: Fracture of enamel and dentine with pulp involvement.

Class 4: Discolouration of the tooth as a result of concussion to the tooth, with or without a sinus.

Class 5: Displacement; extrusion, intrusion, and lateral displacement.

Class 6: Tooth loss as a result of trauma.

Class 7: Tooth restored by composite or crown following fracture.

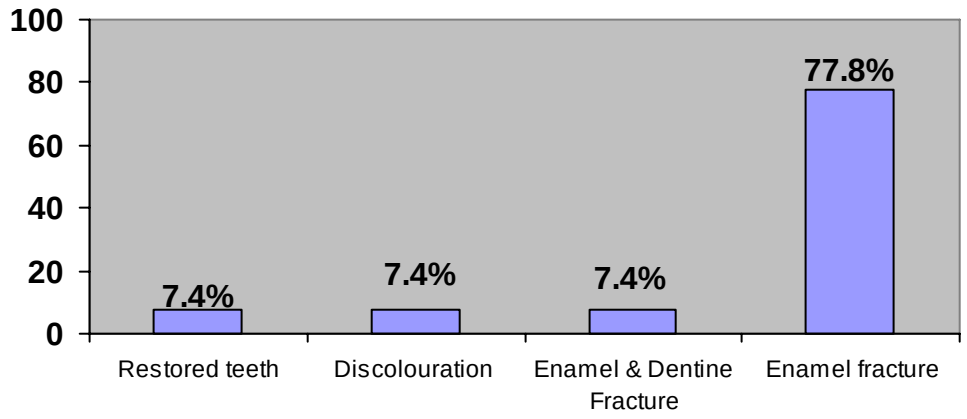
The distribution of different classes of injury is shown in Table 3.

Table 3: Distribution of the different classes of injury.

Class of injury	No: of children(cases)	Percentage
1	21	77.8 %
2	2	7.4 %
3	0	0
4	2	7.4 %
5	0	0
6	0	0
7	2	7.4 %
Total (n)	**27**	**100**

Enamel fractures were the most common type of trauma found in 21 cases (77.8%).

Fig 3: Different classes of injury



In this study, soft tissue injuries were only recorded if signs and/or symptoms such as (concussion, intrusions, extrusions and luxations) were present at the time of the examination.

The relationship between traumatic injury and increased overjet is shown in Table 3.

Table 3: Relationship between traumatic injury and overjet

Normal overjet (277)		**Increased overjet (13)**	
No injury	**Injury**	**No injury**	**Injury**
251(90.6%)	26(9.4%)	12(92.3%)	1(7.7%)

Fig 4: Normal Overjet and injury

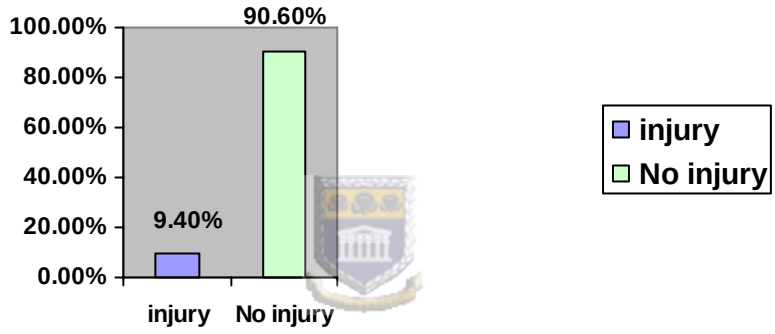
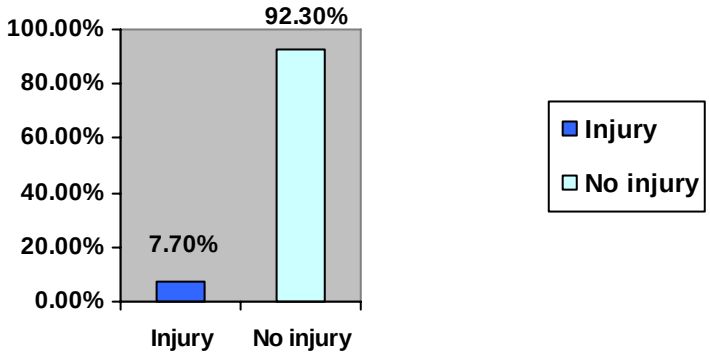


Fig 5: Increased Overjet Child with Injury



Since 7.7 % of children with increased overjet (>5mm) sustained injury and 9.4 % of normal overjet children sustained injury there was no relationship found between increased overjet and increased susceptibility of injury.

Etiology

In the present study, falls were the most frequent cause of trauma in all age groups is generally supported by other studies. The major causes of dental trauma was fall 12 cases (44.4%), and followed by unknown 8 cases (29.6%) and misuse 5 cases (18.5%).

Table 4: Causes of trauma

Cause of injury	No: of children(cases)	Percentage
Fall	12	44.4
Unknown	8	29.6
Misuse	5	18.5
Assault	2	7.5

CHAPTER 6: DISCUSSION

From an epidemiological point of view, the findings of this study concurred with the available literature reviewed. The finding that boys sustained more dental injuries than girls agreed with studies from different part of the world (Nick-Hussein et al. 2001; Rocha et al. 2001; Hamdan et al. 1995; Petti et al. 1996). This could be due to the fact that more boys participate in more aggressive types of games and outdoor activities than girls. Table 5 compares the prevalence of the several studies from difference part of the world.

Table.5. Summary of the prevalence of traumatized anterior teeth in children aged 9-16 years

Study	**Country**	**Age**	**Prevalence**	**Male : Female**
This study	*Lesotho*	*10-14*	*9.31%*	*2:1*
Artun (2005)	Kuwait	13	19.3% boys 9.7% girls	2:1
Marcenes (2002)	London	14	43.8%	1.35:1
Nick-Hussein (2001)	Malaysia	16	4.1%	2:1
Cortes (2001)	Brazil	9-14	11.3%	1.7:1
Nicolau (2001)	Brazil	13	20.4%	2.1:1
Marcenes (2000)	Brazil	12	15.3%	2:1
Marcenes (1999)	Syria	12	11.7%	1.1:1
Hargreaves (1995)	South Africa	11	15.4%	1.5:1
Hamdan (1995)	Jordan	10-12	19.2%	1.7:1

In this survey, the prevalence of traumatic injury to permanent incisor of school children was 9.31% and this was considered as 'moderate', when compared with other studies that used the same methods and diagnostic criteria.

This study has shown that maxillary teeth are more frequently traumatized than mandibular teeth (92.5% and 7.5%), and this probably relates to the more vulnerable position of the maxillary incisors. This finding too, is supported by the literature (Nick-Hussein et al. 2001, Rocha et al. 2001).

The most commonly affected tooth was the maxillary left central incisor (48.4%), followed by the maxillary right central incisor (29.6%). This was similar to the finding of Saroglu et al. (2002), but not with Nick-Hussein et al. (2001) and Cardoso et al. (2002), who found no significant differences related to the location of the tooth.

In this study, 7.7 % of children with increased overjet (>5mm) sustained injury, while 9.4% of normal overjet children sustained injury indicating that no relationship was found between an increased overjet and increased susceptibility of injury. This may be due to the small number of children with increased overjet (n=13). This finding concurred with Marcenes (Marcenes et al. 2000), but was contrary to other findings (Hamdan et al. 1995; Petti et al. 1996), who reported that children with an overjet size greater than 5.0mm were 1.37 times more likely to have a dental trauma than children with an overjet size equal or lower than 5.0mm.

Enamel fractures were the most common type of trauma found in the present study, with 21 cases (77.8%). Children with Class 1 enamel fractures do not generally seek dental care, because there are usually no symptoms or in some instances may be unaware of the injury to the tooth.

Falls were found to be the main aetiological factor of dental trauma affecting 12 cases (44.4%). Most of the injuries only caused slight trauma, and both the children and their parents were unconcerned about the injuries and often did not remember the circumstances of the traumatic event. This could be why the category "unknown cause" was 29.6% in slight enamel fracture group.

A single child with a fractured tooth reported sustaining this after a fall from a horse while on a field study. Thus, the field trip leader and teachers should ensure care of child especially when they are introduced to a new experience with potential risk factors for dental traumatic injuries.

The causes of dental injuries vary in different countries according to local customs. In this study most of the injuries occurred during play. This may be compounded by the nature of the ground surfaces in Lesotho (a mountainous country), as most of the surfaces are rocky and uneven making it easy for a child to slip or trip while playing. Several studies reported falls as being the most common aetiological factor (Hamdan et al. 1995; Saroglu et al. 2002; Nicolau et al. 2001) in dental trauma.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

Oral health is a significant component of general health and oral diseases affect all human beings irrespective of location, country, nationality, race or colour. Although many oral diseases are not always life-threatening, they are of public health import due to their high prevalence and impact on individuals and society in terms of pain, discomfort, social and functional limitation and handicap, and the effect on the child's quality of life. The treatment and management of the injuries to the teeth, may cost more than the treatment of carious cavities. Furthermore, traumatic dental injuries are preventable. Public health preventive and promotive programmes should be adopted to reduce the prevalence.

Health promotion policies should aim to create an appropriate and safe environment. Soft playground surfaces, school-crossing patrols, marked zebra crossings and bicycles lanes would help create a safe environment. Speed limits for cars, the use of seat belts, air bags, special car seats for children and bicycle helmets should be enforced. Mouth guards should be used when playing sport, in particular contact sports.

Education regarding the epidemiology of dental injuries and its prevention through health promotion may play a major role in reducing the prevalence of dental injury and avoiding the financial costs of treatment, especially in developing countries.

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APPENDIX 1: QUESTIONNAIRE

Student name..... Code number.....

School name..... Code number.....

Date of the interview: Month.....

1. Have you ever had an accident that involved your mouth/teeth?
(1) Yes
(2) No

2. If yes, ask which tooth/teeth were affected by the accident?

12	11	21	22
42	41	31	32

3. When did the accident that damages your tooth/teeth happen?

month...../year.....

4. How did the accident happen?
(1) Fall from stairs
(2) Fall from windows
(3) Fall from playgrounds equipment
(4) Fall from bicycling
(5) Other type of fall (specify)

.....
(6) Traffic accidents (specify)

.....
(7) Collision against objects (specify)

.....
(8) Violence (specify)

.....

(0) Other (specify)

.....

6. What caused the accident that damaged your tooth/teeth? (i.e.: pushing, tripping, slipping)

7. Where did the accident happen?
(1) Home
(2) School
(3) Street
(4) Club
(5) Park
(0) Other (specify)

.....

8. Please give more details of the place where the accident happened.
(1) Swimming-pool
(2) Playground
(3) Football ground
(0) Other (specify)

.....

9. Could you please describe in a few words the place where the accident happened? (i.e. surface type, surroundings, etc)

.....

.....

.....

10. As a result of the accidental damage of your tooth/teeth did you have to take any time off school?
(1) Yes
(2) No

If yes, How much time?

Number of days.....

APPENDIX 2: DATA CAPTURE SHEET

School name..... Code number.....

Student name..... Code number.....

Date of dental examination Month.....

Year.....

Date of birth Month.....

Year.....

Age in years .....

Gender Male (1)
Female (2)

Damage of the tooth/teeth:

12	11	21	22

42	41	31	32

Damage	*Code*
Fracture of enamel only.	01
Fracture of enamel and dentine, without pulp involvement.	02
Fracture of enamel and dentine with pulp involvement.	03
Discolorations of the tooth, with or without a sinus.	04
Displacement, extrusion, intrusion, and lateral displacement.	05
Tooth loss as a result of trauma.	06
Tooth restored by composite or crown following fracture.	07

Treatment provided:

12	11	21	22

42	41	31	32

Type of treatment provided, if any	*code*
Untreated trauma	1
Acid etch restoration	2
Permanent crown	3
Denture due to trauma	4
Other restoration (specify)	0

.....

Treatment need:

12	11	21	22

42 41 31 32

Type of treatment needed, if any	*code*
No treatment needs	1
Acid etch restoration	2
Permanent crown	3
Denture	4
Acid etch restoration & endodontic treatment	5
Acid etch restoration, endodontic treatment & bleaching	6
Permanent crown & endodontic treatment	7
Other restoration (specify)	8

.....

Incisor overjet: Largest incisor overjet..... mm

Lip coverage: Adequate 1
Inadequate 2

APPENDIX 3: INFORMATION LETTER

Dear Parents,

I am a Masters student from the Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape and am investigating dental trauma among children. This is a major public health problem. I am hoping that this research will help us identify problems of dental trauma among school-children in our country. This project is going to give us the opportunity of promoting prevention. Your child was chosen to represent a group of the population, thus it is very important that you collaborate answering the enclosed questionnaire and returning it to us.

Dental trauma may be prevented by adequate measures. In order to develop prevention programmes we need to identify the main causes. Therefore, your child's participation is essential for the success of this research and to the improvement of the oral health of the population of our country as a whole.

I would like to thank you in advance for your co-operation.

Yours sincerely

.....

Dr H Lin

APPENDIX 4: CONSENT FORM

June 2005

Dear Parent of ……..,

We are from the Department of Community Dentistry at the University of the Western Cape. As you know from the information sheet that was provided to you accidental damage to the teeth is a major problem and may occur during sports, at unsafe playgrounds or schools and through road accidents or violence. We are interested in examining your child's mouth and teeth to look for any problems related to traumatic injuries. We are doing this to see if there are ways in which we can prevent the problems or help with any problems they may have.

The procedure will take about 12-20 minutes. There are no risks in participating and there should be no more discomfort than in a routine dental check up examination. All information gathered in the study will be treated as strictly confidential. No one will have access to this information except the researcher. Neither your name nor anything that identifies you will be used in any reports of this study. All information collected will be maintained and stored in such a way as to keep it as confidential as possible. You can withdraw from the study at any time without any penalties.

If you would like your child to take part in the study, please sign the bottom of this letter. If you would like to know anything more about the study, please contact Professor Su Naidoo on telephone number at work 021-937 3148 or at home on 021-686 2720.

Thank you for your co-operation

Yours sincerely

Prof: Sudeshni Naidoo

I understand what will be required of my child to take part in the study. I agree to allow my child to participate in the research being undertaken by Prof Sudeshni Naidoo. I understand that at any time I may withdraw my child from this study without giving a reason and without affecting his/her normal care, management or schooling.

Name: .....…….. .....……
(print in block letters) (Signature)

Telephone Number: …….

Date: .....……

Witness: ……