

**DENTOFACIAL TRAUMA IN SELECTED  
CONTACT SPORTS AMONG HIGH SCHOOL  
STUDENTS IN NAIROBI CITY COUNTY**

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## DECLARATION

I, Thomas Munyao Jr, hereby declare that this dissertation is my original work and has not been presented for the award of a degree in any other university.

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## APPROVAL

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## **DEDICATION**

This dissertation is dedicated to my loving, supportive and caring wife, Diana Masara Kemunto and my son, Gabriel Mumina Munyao Junior.

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## LIST OF ABBREVIATIONS

BDS	Bachelor of Dental Surgery
CI	Confidence Interval
FDI	Fédération dentaire internationale
MChD	Magister Chirurgiae Dentium
MDS	Master of Dental Surgery
MG	Mouthguard
PI	Principal Investigator
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
TDI	Traumatic Dental Injuries
UoN	University of Nairobi
USD	United States Dollars
UWC	University of the Western Cape
WHO	World Health Organization
$\chi^2$	Chi Square
F	Anova
$\chi^{2*}$	Fisher's exact test
%	Percentage

## **ABSTRACT**

**INTRODUCTION:** Physical activities such as sports which are competitive at all levels are increasingly becoming popular worldwide. In light of this, Kenyan youth are participating more in competitive sports. Unfortunately the health benefits of sporting activities can be antagonised by injury risks to the dentofacial region which include injuries to the hard and soft tissues. Clinicians are therefore more likely to encounter sports - related injuries.

**STUDY OBJECTIVE:** To determine the pattern of occurrence of sports-related dentofacial injuries among athletes participating in Rugby and Football in Nairobi City County, Kenya.

**STUDY AREA:** The study was conducted in 17 secondary schools in Nairobi City County. The schools participated in Rugby Prescott and Damu Pevu tournament during the 2015 tournament and the Nairobi Football League 2015 season in Nairobi City County.

**STUDY DESIGN:** This was a descriptive cross-sectional study.

**MATERIALS AND METHODS:** A total of 510 students were sampled through stratified random sampling from 12 Rugby and 17 Football teams. The study population comprised of male high school students between the ages of 14 and 18 years. A semi-structured questionnaire was used to assess the prevalence of dentofacial injuries, the aetiology, severity and the type of injury. The questionnaire also evaluated the awareness, use and type of mouthguard. A clinical examination of the selected students was carried out and data entered into a modified World Health Organization Oral Health Assessment Form for Children (2013) to determine their dental trauma status.

**DATA ANALYSIS AND PRESENTATION:** The data collected was coded, entered,

cleaned and analysed using the Statistical Package for Social Sciences (SPSS) version 22. Chi – square ( $\chi^2$ ), Fishers exact test, odd's ratio and Anova (F) were used. The confidence level was set at 95% ( $p \leq 0.05$ ).

**RESULTS:** Five hundred and ten students participated in this study. Two hundred and eighty one (55.1%) reported having experienced dentofacial injuries. Participants playing both sports had a statistically significant higher prevalence of dentofacial injuries (66.7%), as compared to Rugby (54.3%) and Football players (54.1%) ( $\chi^2 = 7.40$ ,  $df = 2$ ,  $p = 0.02$ ). Clinical examination revealed 39% of the participants had experienced dentofacial injuries. The most prevalent injury reported was soft tissue injury at 68.3%, tooth injuries at 19.5% and combination injury of hard and soft tissue at 8.1%. Bone fractures stood at 3.9% of the total dentofacial injuries.

Three hundred and fifty (68.6%) athletes knew what a mouthguard was but a significantly lower number of 105 (20.6%) actually used mouthguards ( $\chi^2 = 36.45$ ,  $df = 4$ ,  $p = 0.00$ ). Of all the respondents, 250 (49%) believed wearing a mouthguard would reduce the prevalence or occurrence of dentofacial injuries during sporting activity. The prevalence of dentofacial trauma was significantly lower in athletes who wore mouthguards.

**CONCLUSION:** More than half of the study participants had experienced dentofacial injuries with soft tissue injuries being the most commonly reported. Although, the majority of the athletes knew what a mouthguard was, less than a fifth actually used them. Over half of the athletes were not sure that mouthguards could reduce the prevalence and/or severity of dentofacial injuries. Participants who used mouthguards

demonstrated a significantly lower prevalence of dentofacial injuries in comparison to non-users.

**RECOMMENDATION:** There is need to educate the athletes on the dentofacial injuries that they can sustain while participating in sports and on how to minimise the occurrence of the dentofacial injuries.

# CHAPTER ONE

## 1.0 INTRODUCTION AND LITERATURE REVIEW

### 1.1 INTRODUCTION

Sporting activities have been used as a way of engaging in physical activities mainly for competitive purposes but also for recreational purposes. Unfortunately, this can predispose one to dentofacial injuries which can affect an individual both physically and psychologically<sup>1</sup>.

A traumatic injury has been defined by Fuller et al<sup>2</sup> as an injury from a particular event that can be identified. Zahid et al<sup>3</sup> defined trauma as 'an injury; damage; impairment; external violence producing injury or degeneration'. A sport-related injury is defined as "any discomfort as a result of pain or physical impairment as a result of trauma during a competitive sport which causes the athlete to miss subsequent games"<sup>2</sup>. The definitions of an injury as described in the rugby injury consensus statement<sup>4</sup>, is adopted to suit the needs of this study. It is defined as 'any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, that was sustained by a player during a rugby/football match and/or training and required attention from a Paramedic team at the site of play, irrespective of who decided this.'

In 1994, the American Academy of Paediatrics categorized sports by their probability for collision or contact. In "collision" sports such as rugby and American football, players wilfully/intentionally hit or run into each other or insentient objects with high force. In "contact" sports such as basketball and football, players/athletes regularly

touch each other or inanimate objects with less force than those in former group. However, there is no clear difference between the two definitions<sup>5</sup>. Therefore, the use of the term “contact sports” in this study shall be preferred. Contact sports often increase the risk of traumatic injuries to dentofacial tissues. These injuries are reported to be most prominent in players participating in rugby, football, basketball, hockey, and boxing<sup>6</sup>. Rugby has been classified as a potentially ‘high-risk’ sport by the World Dental Federation (FDI) as an athlete has a high chance of sustaining dentofacial trauma<sup>7</sup>.

Prevalence in this study shall be defined as the number of children experiencing sports-related dentofacial trauma, in a given population at a designated time point<sup>8</sup>. According to Kececi<sup>9</sup>, dentofacial trauma has been reported to be between 6% to 60% in children and young adults in several nations. The dentofacial trauma rates in high school children ranged between 6% in an Australian study<sup>10</sup> and 34% in a study by Hamilton et al<sup>11</sup>. A New Zealand study by Dearing<sup>12</sup> further observed that 19% of the permanent incisors sustained trauma while Kaba and Marechaux<sup>13</sup> documented it as 11% in children aged 16 to 18 years of age. Appropriate preventive measures can be instituted to minimize the occurrence of such injuries. While numerous studies exist on this topic from several countries throughout the world, there is paucity of data in Kenya. Rugby is popular globally, with an estimated 119 countries currently participating in various tournaments worldwide. Figures from the International Rugby Board show that it is increasingly popular with teenagers, who represent 22% to 39% of registered players in the top five Rugby-playing nations<sup>14</sup>. Rugby enjoys particular popularity in Kenya with estimated 29000-30000 players’ nationwide<sup>14</sup>. Rugby and Football are progressively becoming professional sports in

Kenya, hence the increase in interest from the youth whose participation has increased.

The purpose of this study therefore was to determine the pattern of occurrence of dentofacial injuries among Kenya amateur athletes, who participate in rugby and football and the association of these injuries with the use of mouthguards. Through the results of this investigation, it is hoped that injury prevention strategies may be enhanced at these age groups to prevent unnecessary injuries during future tournaments.

## **1.2 LITERATURE REVIEW**

### **1.2.1 Aetiology of sports-related dentofacial trauma**

With the development of sports dentistry, the causes of dentofacial trauma have been investigated and a number of studies on the prevalence and aetiology of sports-related injuries have been conducted<sup>5,6,9</sup>. Overall dentofacial trauma can arise from various causes<sup>15, 16</sup>. These causes include collisions, sports, falls, traffic accidents and interpersonal violence. Behavioural risk factors such as hyperactivity have also related with dentofacial injuries among athletes<sup>17</sup>. In schools, the risks for traumatic injuries during sports include a trip or a fall during training and competitive games, a hit from arms, elbows, forearm, hands, head or from inanimate objects such as balls and hockey sticks. However, the danger is not limited to the sports competitions; up to 25-30% of the accidents occur during training<sup>18</sup>. In a Finnish study by Sane et al<sup>18</sup> on traumatic dental injuries in contact sports, it was reported that the aetiology of dental injuries were a kick or a blow from either a stick or



another player at 32.8% and 31.1% respectively. This was followed by collisions and tackles at 20.9%. Most of the athletes sustained injuries during the matches with 68.6% of the accidents occurring during the competitive game<sup>18</sup>. In another study by Tin-Oo et al<sup>19</sup> in Malaysia, the common cause of injuries experienced by athletes was by collision between players, falling on their face and a strike from an object or equipment.

It has been documented in many studies that participation in sports carries a considerable risk of one experiencing dentofacial injuries<sup>20</sup>. Furthermore, an increase in age and level or grade of play coupled with greater speed<sup>21</sup>, increased competitiveness or aggression<sup>22</sup>, increased height and weight<sup>23</sup> and increased foul play at higher levels of play predisposes one to dentofacial injuries. In the Czech Republic, it has been documented that sport activities are among the leading causes of traumatic dental injuries to permanent teeth in people older than 11 years<sup>24</sup>. This is significantly increased in children who have malocclusion such as increased overjet which is common in patients with class II malocclusion with inadequate lip coverage<sup>25</sup>. This can be corrected or modified by a dental professional by instituting preventive orthodontic treatment during the early to middle mixed dentition in patients with an overjet greater than three millimetres.

The injury risks are quite higher in Rugby than in football with 69 injuries per 1000 hours exposure compared to 28 injuries per 1000 hours exposure<sup>26</sup>. This can be attributed to the nature of the game as rugby is characterized by short, intermittent bouts of high-intensity exercise with the 30 players having multiple contact situations during the game as compared to Football which has less players and less contact

situations<sup>27</sup>. In a study among high school male football players in Rwanda with an average age of 16.8 years, defenders were the most commonly affected players (22.6%) with most of the injuries being as a result of collision with another player (24.2%)<sup>28</sup>.

Sporting activities are not only the major causes of dentofacial injuries. In a study of the prevalence of oral trauma in the para – pan American Games athletes<sup>29</sup>, almost 47.5% of the all the participants had experienced a previous traumatic injury and only a prevalence of 12.5% of traumatic oral injuries was obtained in relation to sports. This was lower than the other reported causes of traumatic injuries in this study. The findings of the above study were corroborated with a study on traumatic injuries in children with cerebral palsy who had 57% traumatic injuries to the oral cavity. The injuries were attributed to the children's disability and not sports<sup>30</sup>. Hence, children with cerebral palsy are at a higher risk of sustaining dentofacial injuries.

However, this study investigated only the sports-related injuries to the dentofacial tissues in a sample of students participating in Rugby and Football in two tournaments in Nairobi City Country, Kenya.

### **1.2.2 Types of sports-related dentofacial injuries**

The majority of sports-related dentofacial injuries have been shown to affect both the hard and soft tissues of the oral cavity. These dentofacial injuries include: complicated and uncomplicated fractures of the teeth, tooth mobility or displacement (luxation), avulsion of teeth, jaw fractures, lacerations and other soft tissue injuries<sup>1</sup>.

The maxilla and permanent incisors sustain between 50 to 90 percent of the injuries

involving the maxilla and the upper lip<sup>31</sup>. No study has reported such injuries to the mandibular incisors.

Hecova et al<sup>24</sup> in the Czech Republic reported that 80% of traumatic dental injuries involved the maxillary permanent incisors. In a study by Lang et al<sup>32</sup> involving handball players in Switzerland, there were 2799 dental injuries affecting 2577 teeth, with an average of 1.8 injuries and 1.7 teeth per accident. Seventy five percent of the injured teeth were the maxillary teeth. Uncomplicated crown fractures were the most frequent type of injury at 43.0% followed by complicated crown fracture at 17.4%. Among the dentition, the maxillary incisors had the highest injury rates with the right maxillary incisor affected in 38.9% of the cases. The left maxillary incisor had injury rates of 38.1% of all the accidents. In a recently published study on traumatic dental injury in Kenya, Muasya et al<sup>33</sup> reported enamel fracture to account for 68.9% followed by enamel-dentin fracture at 23.8%.

In a study carried out in Malaysia, soft tissue injuries occurred more frequently with laceration of the lips, tongue and cheek being reported at a prevalence of 57.5% followed by bruises on the face at 50.0%. Hard tissue injuries namely tooth mobility, fracture of teeth and dentofacial bone fractures were less common occurring in 12.5%, 10.0% and 5.0 % of the study participants' respectively<sup>19</sup>. In a study carried out in Kenya to determine the pattern of occurrence of dental and maxillofacial injuries<sup>34</sup> in a hospital setting, there was a greater proportion of dental injuries (80.3%) than facial fractures (8.3%) and soft tissue injuries (29.9%) with maxillary incisors being commonly affected in these traumatic situations. However, no data is available on dentofacial injuries associated with Rugby and Football in Kenya.

Several factors predispose players to traumatic dental injuries such as inadequate lip coverage and increased overjet. However, these predisposing factors to traumatic dental injuries were not investigated in this study.

### **1.2.3 Epidemiology of sports related dentofacial injuries**

The prevalence of dental trauma in various epidemiological studies has been found to differ considerably. 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. Sports are some of the common causes of dentofacial injuries, with sports-related injuries accounting for 1.4%-39.0% of all traumatic cases in the dentofacial region<sup>35,36,37,38,39,40</sup>. Boys are normally at higher risk of experiencing dentofacial trauma than their female counterparts. In a Kenyan study on traumatic dental injuries, no girl had sustained any injury as a result of games<sup>33</sup>. The most frequent dentofacial injuries include lacerations, avulsion of one or several teeth (most frequently loss of maxillary central incisors), maxillomandibular fractures, dentoalveolar fractures and temporomandibular joint injuries as a result of trauma<sup>35</sup>.

In two different studies in the USA, It was reported that 36.0% of all accidental injuries were sports-related<sup>36</sup> and in the other study 33.0% of all dental injuries and 19.0% of all injuries to the head and face were as a result of sports. In the Scandinavian countries, 10 -19.0% of athletes sustained serious sports injuries to the extent of being taken to the emergency department for management<sup>37</sup>. In a Swedish study<sup>38</sup>, the head was considered to be the third most injured part of the body after the hand and foot respectively as 18.0% of all injuries were of the head,

face, teeth or jaws. This was irrespective of the age and cause. In the same study<sup>38</sup>, 23.0% of sports-related dentofacial injuries were documented in the age interval of 7–30 years. In a study carried out in Malaysia<sup>19</sup>, 22.2% of the players had sustained at least one type of traumatic dentofacial injuries which were sports-related. Similar findings were obtained in other studies where 22.3% and 20.4% of the athletes reported to have sustained dentofacial traumatic injuries respectively<sup>40</sup>.

In Rugby, the reported dentofacial injury rates vary between 13% and 56.5%<sup>39,41</sup>. The prevalence of dentofacial injuries rates in high school football has been reported at 28%-32% in a two year observation study<sup>16</sup>. In another study in Brazil, 23.1% of the football players had experienced traumatic dental injuries associated with sports<sup>6</sup>. It can be concluded that injuries to the craniofacial region and neck in general are quite common in competitive and non- competitive games.

In African studies, the prevalence of sports-related injuries varies from 30.2% to 75.0%<sup>28,33,42,43,44,45</sup> with Rwanda<sup>28</sup> reporting the highest prevalence of 75.0% among Football players. In Kenya, Muasya et al<sup>33</sup> attributed 2.4% of traumatic dental injuries among children between the ages of 12-15years to be as a result of sports. However, the study included a younger age group than other studies and did not focus on athletes only. A study on traumatic injuries to the maxillary teeth and upper lip in Tanzania clearly showed the high prevalence of injuries in boys compared to girls at 48.8% against 38.8% for females<sup>45</sup>. This is further supported by a study carried out in Kenya in which males accounted for 18.8% and females 13.5% with falls being the major cause of traumatic dental injuries<sup>33</sup>. A Kenyan study by Murithi et al<sup>34</sup> reported that boys sustained injuries 1.85 times more than females hence

making boys a suitable sample for this present study. The male age group with the highest prevalence of sports-related dentofacial injuries has been reported to be between 15 and 18 year olds<sup>46</sup>.

#### **1.2.4 Complications or sequelae and cost of dentofacial trauma**

Dentofacial trauma is a public health problem in our society that affects many people. It can lead to irreversible dental loss years after the accident. Dentofacial injuries usually require expeditious emergency management as well as long term follow up. The first awareness of the fact that traumatic injuries to the dentofacial region posed health problems in the past was associated with contact sports such as boxing, American football, and more recently track-and-field events<sup>47</sup>.

Berger et al<sup>48</sup> showed that dentofacial trauma affects the quality of life not only of the injured player but also of the guardians as it can affect them psychologically by its potential for pain to the injured player and economically as a result of lost hours for the child and parent from school and work respectively. Furthermore, children with un-treated traumatic injuries to their permanent dentition have a potential of being affected during their daily living compared to those who do not have any injury. The yearly costs of all injuries, including dentofacial injuries, sustained by young athletes have been estimated to be as high as 1.8 billion dollars<sup>49</sup>. Significant high costs can accrue over a patient's lifetime as a result of dentofacial injuries as the athlete might require prosthodontic, restorative, endodontic, implant or surgical treatment as a result of dental injuries and dentoalveolar fractures. The costs of managing dental injuries are high and adversely affect people in the lower social cadre and non-insured who are the majority in Kenya<sup>49</sup>.

Despite all the pleasure derived from sports, participation may result in severe injuries. The average cost of treating a patient with traumatic dental injuries in Finland was USD 320<sup>50</sup>. Complicated crown root fracture was the most expensive to manage at USD 750, followed by root fractures at USD 720 and finally extraction at USD 680<sup>50</sup>. Furthermore, it is believed that a total of USD 460 million is spent annually in Sweden to manage sports injuries<sup>51</sup>. Rugby and Football injuries are expensive to treat. The annual worldwide medical cost on Football injuries is estimated by Fédération Internationale de Football Association (FIFA) to be USD 30 billion<sup>52</sup>. Although this amount may far exceed the cost incurred by Kenyan high school teams, these players may sustain more or less similar injuries. Kenya being a third world country also bears substantial costs on sports injuries.

### **1.2.5 Mouthguards**

Mouthguards (MGs) were first used in sports in the 1920s. This was mainly in boxing. Later on, the devices were introduced into use in other sports in the 1960s<sup>53,54</sup>. The mouthguard, also referred to as a gumshield or mouth protector, is defined as “a resilient device or appliance that is used in the oral cavity to prevent traumatic injuries to the oral tissues especially the hard tissues (teeth) and surrounding structures”<sup>50</sup>. The appliance was constructed to “confer protection to the extraoral soft tissues which includes the lips and intraoral soft tissues from laceration and bruising, the dentition from complicated and uncomplicated crown fractures, root fractures, luxation injuries and avulsions, the jaws especially the maxillae from fractures and dislocations at the temporomandibular joint and to provide support for edentulous space”<sup>55</sup>.

Mouthguards can be used during training and competitive games to give all round protection/prevention against dentofacial injuries<sup>56</sup>. The mechanism of action of mouthguards is that it acts as a separator between the hard tissues which include the teeth and the soft tissues which include the lips and cheeks thus lowering the chances of a user experiencing soft tissue lacerations and opposing teeth from occluding traumatically. The mouthguards offers a strong surface with the capability of “absorbing the impact energy and dissipating the remaining energy”<sup>57,58</sup>. The importance of using mouthguards has been widely accepted as the prevalence of dentofacial injuries such as lacerations and bruises as well as maxilla-mandibular fractures are significantly reduced<sup>59</sup>.

The American Society for Testing and Materials (ASTM) classifies mouthguards by three categories<sup>60</sup>:

- I. Stock mouthguards, which are prefabricated in different sizes and mainly bought over the counter. They are the worst in terms of conferring protection;
- II. Mouth-formed, also known as boil and bite mouthguard, made from a thermoplastic material, and immersed in hot water so as to soften and formed in the mouth of the athlete;
- III. Custom-made (fabricated) mouthguards made by dentists on a model of the patient’s mouth by use of a vacuum and ideally covers all the teeth<sup>47, 50, 60</sup>.

Custom fabricated mouthguards are considered superior compared to other types of mouthguards due to the better adaptation, comfort, retention and for their minimal interference in both speech and breathing. Custom-made mouthguards are fabricated from a thermoplastic material by either vacuum-forming or pressure-



forming over a stone or plaster model of the patient's dentition<sup>61</sup>. However, the most commonly used mouthguard in Kenya are boil and bite and stock mouthguards as they are easily available in sports shops, easy to use and relatively cheap compared to the more durable custom-made mouthguards which are more expensive as laboratory fees and dental fees have to be factored in. Lang et al<sup>32</sup> documented that among amateur athletes, the stock mouthguard was commonly used and more well known amongst amateur athletes while semi-professionals were more aware of custom fabricated mouthguards. This was attributed to the fact that, the semi-professional athletes had a better health care cover compared to amateur athletes; hence they are exposed to more information and recommendations to use custom made mouthguards.

Several studies have reported that the risk of dentofacial injuries as a result of competitive and non-competitive games can be reduced significantly by the use of mouthguards<sup>54, 62, 63, 64, 65</sup>. Hecova et al<sup>24</sup> suggested that the use of a mouthguard is important in lowering the risk of dentofacial injury as athletes are 60 times more likely to suffer harm without the device. It also confers protection to the teeth and periodontal structures as the incidence and severity of sports-related injuries are reduced<sup>6</sup>. An Australian study on Rugby players documents the knowledge among the athletes about the positive effect of mouthguards for accident prevention while participating in sports<sup>66</sup>.

In a study carried out in France, Germany and Switzerland, only one athlete who had sustained a dentofacial injury while playing squash used a mouthguard<sup>67</sup>. Professional athletes tend to use mouthguards more than amateur athletes. This

depends on the discipline of the sport and the need to use protective devices such as mouthguards. In certain sports such as cycling, helmets and elbow pads are used; mouthguards are not an integrated part of the protective gear.

In a study of para – pan American games athletes<sup>29</sup>, only two (1.7%) participants used the boil and bite mouthguard while the rest did not use any type of mouthguard. In Israel<sup>58</sup>, only 27.0% athletes were aware of the need to use protective devices such as mouthguards to prevent dentofacial injuries. Unfortunately, only three percent of the athletes used mouthguards. The surveyed population comprised of professional and amateur athletes<sup>58</sup>. In Brazil<sup>6</sup>, 28.8% of the athletes had experienced dentofacial trauma while 15.9% athletes wore mouthguards while participating in sports. However, majority of the athletes (52.4%) knew about the need of using a mouthguard. Only 1.4% of the football players used mouthguards while 11.9% of the total football players knew the need of a mouthguard<sup>6</sup>. In a study carried out in Malaysia<sup>19</sup>, none of the athletes sampled used mouthguards during sporting activities. However, 33.9% of the athletes had prior knowledge concerning mouthguards and its ability to prevent injuries. The reasons for athletes not using mouthguards were: athletes did not find them important (56.1%), lack of advice by coaches (32.2%) and discomfort caused by mouthguards (21.7%). Surprisingly cost was not reported as a factor for mouthguard use. In Singapore, 56.0% of the schoolboys' surveyed had prior knowledge about mouthguards but none of them used the device<sup>62</sup>. In another study on mouthguard usage during competitive sporting activities in Ankara (Turkey), it was found that none of 11-18 years olds used mouthguards while participating in sports<sup>68</sup>. Boffano et al<sup>69</sup> reported that only 53.9% of the rugby athletes in Northern Italy wore mouthguards during sport and training.

It has been documented that approximately 36.0% of dento-alveolar injuries occur with mouthguards in place<sup>70, 71</sup>. In a study conducted on mini rugby players in England, 36.0% of the participants who wore mouthguards had sustained dentofacial injuries while 74.0% of the non-users sustained dentofacial injuries<sup>71</sup>. The use of a mouthguard has not been enforced in many sports federations worldwide. Athletes, especially amateurs, often avoid using them<sup>37, 72</sup>. Athletes have given various reasons on why they do not use this protective device. These reasons include: poor aesthetics, difficulty in speech, breathing difficulties, stability, dry mouth and nausea<sup>72</sup>. These complaints are as a result of the low quality or substandard mouthguards used by most of the sportsmen. However, this can be overcome by the use of a more superior mouthguard which can only be found in the custom-made mouthguard<sup>62, 72</sup>. Four New England states in the United States of America have been successful in enforcing the use of mouthguards in sports such as basketball, football and wrestling<sup>73</sup>.

From the literature review, it is apparent that there is low awareness rate of the importance and use of mouthguards in the prevention of the sports-related dentofacial injuries. Athletes should be well informed and educated on appropriate methods of protection as they are all at risk. Furthermore, they should be educated on the short and long term consequences of sports-related dentofacial injuries so as to use proper protective devices to avoid injuries to the dentofacial region<sup>31</sup>. This signifies the need for proper education to both the professional and amateur athletes on prevention of sports-related dentofacial injuries.

In Kenya, use of mouthguards has not become widespread in sports other than Rugby as students playing other sports such as Football may not have the

knowledge or awareness of their use in prevention of dentofacial injuries.

The prevalence of dentofacial injuries as a result of sporting activity ranges from 1.4%-39.0%<sup>20,35,40,48,51</sup> in children with collision and fall being one of the major causes of trauma. It has been reported in literature that the maxillary right central incisor has the highest prevalence of injuries among the dental hard tissues. Contact sports such as rugby and football have been linked with high prevalence of dentofacial injuries worldwide. This study was conducted to determine the prevalence of dentofacial injuries among Rugby and Football players and awareness of mouthguards amongst these athletes, in Nairobi City County in Kenya.

## **1.3 RESEARCH PROBLEM**

### **1.3.1 Statement of the problem**

The popularity of organized sports and the increased level of competitiveness among the youth have resulted in an increased number of dentofacial injuries among athletes. Several epidemiological studies have shown sports-related dentofacial injuries among children to be between 1.4%-39%<sup>20,35,40,48,51</sup>. This demonstrates the magnitude of the problem at hand. With high school rugby and football growing in popularity, more information is needed in order to prevent or minimize cases of dentofacial trauma. Sports-related injuries have been found to restrict activities both in school and at home causing time loss among the adolescents and the guardians each year globally.

Despite advances in different types of mouthguards and protective devices available in sports, dentofacial trauma still remains a serious challenge for athletes and dental clinicians as well. Athlete compliance to the use of mouthguard is a problem due to the perception that mouthguards reduce their performance during sporting activity by affecting their ability to communicate and breathe appropriately. This creates a vicious cycle in that they increase their chances of sustaining a traumatic dental injury (TDI). Furthermore, several studies have shown mouthguard use drastically reduces the occurrence of dentofacial injuries and concussions.

Lack of information on the benefits of mouthguard usage has been attributed to failure to use mouthguards and also lack of rules or regulations by the sports governing bodies in Kenya.

### **1.3.2 Justification**

In Kenya, there is a dearth of information on traumatic dental injuries and mouthguard use among rugby and football players as no published data on the present study could be found in Kenya. Studies<sup>6, 22, 47, 50, 53</sup> done elsewhere have shown that sports is one of the major causes of dentofacial injuries among athletes and that the mouth guard helps reduce the prevalence of dentofacial injuries. The present study shall attempt to build on this knowledge base especially with regard to the Kenyan situation.

One of the key objectives of primary protection in contact sports is prevention against injuries. It has been well documented through various studies that athletes are at risk of sustaining injuries while participating in sports<sup>6, 47, 53</sup>. The awareness and usage of mouthguard needs to be addressed from an early stage in the child's involvement of sports so that they get used to it. Through spread of basic dental education on the significance of mouthguard use, dentofacial injuries may significantly be reduced. Awareness and use of mouthguard may help in reducing the negative impact sports has on oral health.

This study provides baseline data regarding the pattern of occurrence of dentofacial injuries among high school students participating in Rugby and Football and mouthguard use. These results may be useful to policy makers in implementing injury prevention strategies.

## **1.4 OBJECTIVES**

### **1.4.1 Broad objective**

To determine the pattern of occurrence of sports-related dentofacial injuries and mouthguard use among athletes participating in Rugby and Football in Nairobi City County in Kenya.

### **1.4.2 Specific objective**

1. To determine the prevalence of dentofacial injuries among Rugby and Football players in Nairobi City County in Kenya.
2. To determine the types of dentofacial injuries sustained by these athletes.
3. To establish the level of awareness and extent of the use of mouthguard.
4. To establish the relationship between the use of mouthguard and the prevalence of dentofacial injury.
5. To compare the patterns of dentofacial injuries in mouthguard users with that in non-users.

## **1.5 HYPOTHESIS**

### **1.5.1 Null Hypothesis**

1. There is no association between type of contact sport and dentofacial injuries experience.
2. There is no association between mouthguard use and prevalence of dentofacial injuries.

### 1.5.2 Variables of the study

The variables investigated in this study are described in Table 1.

**Table 1: Study variables**

Variable	Measurement
<b>Socio-demographic Variables</b>	
Age	Number of years
Playing history	Number of years in particular sport
Education level (class)	Form 1, 2, 3 and 4 or equivalent
School	Public and private
<b>Independent Variables</b>	
Type of sport played	Football, Rugby or Both
Use of mouthguard	Frequency of use Type of mouthguard
<b>Dependent Variables</b>	
Injury sustained during sport	Hard tissue, soft tissue or combination Site of injury



## **CHAPTER TWO**

### **2.0 RESEARCH METHODOLOGY**

#### **2.1 STUDY DESIGN**

This was a cross-sectional study.

#### **2.2 STUDY AREA**

The study was done in Nairobi City County, the capital city of Kenya. Nairobi covers an area of approximately 684 km<sup>2</sup> and an altitude of about 1700 metres above sea level. Nairobi is found within the Greater Nairobi Metropolitan region, which consists of four out of 47 counties in Kenya bordered by Kiambu County to the north, Machakos County to the East and Kajiado County to the South and West.

The study was conducted at high schools participating in the Kenya Rugby Football Union Prescott and Damu Pevu tournaments. The participating teams were from the following schools situated in Nairobi City County: Ofafa Jericho, Strathmore School, Lenana School, St. Mary's School, Moi Forces Academy, Aquinas High School, Dagoretti High School, Nairobi School, Jamhuri High School, Muhuri Muchiri Secondary, Upper Hill High School and Highway Secondary School.

Schools that participate in high schools football tournament in Nairobi City County included: Upper Hill High School, Kanithi Secondary School, St. Mathews School, Ofafa Jericho, Nairobi Milimani, Broothfield School, Olympic mixed Secondary School, Kahawa Garison, Ruthumithu Mixed Secondary, Jamuhuri High, Raila Educational Centre, Lavington Secondary, Moi Forces Academy, Embakasi Garison, Muhuri Muchiri Secondary, Makongeni Secondary, Kamukunji Secondary,

Strathmore School, St Mary's School and Langata High school were also included in the study.

### 2.3 STUDY POPULATION

The study population comprised male students aged 14-18 years participating in Rugby and Football tournaments in the selected schools in the year 2015 within Nairobi City County.

### 2.4 SAMPLE SIZE DETERMINATION

In a study among amateur footballers in Ibadan (Nigeria), 36% of students surveyed had sustained dentofacial trauma<sup>43</sup>. The prevalence rate in the Nigerian study was used in the sample size calculation. Using a confidence interval of 95%, the Fisher's formula<sup>3</sup> below was used to determine the sample size.

Calculating N:

$$N = \frac{Z^2 (P(1-P))}{d^2} = \frac{1.96^2 \times 0.36 \times 0.64}{0.05^2} = 354$$

Total sample size = 354

Minimum number of students per group = 177

N= Sample size

P= Population proportion is taken as the prevalence rate of the Nigeria study (Prevalence of 36% = 0.36)

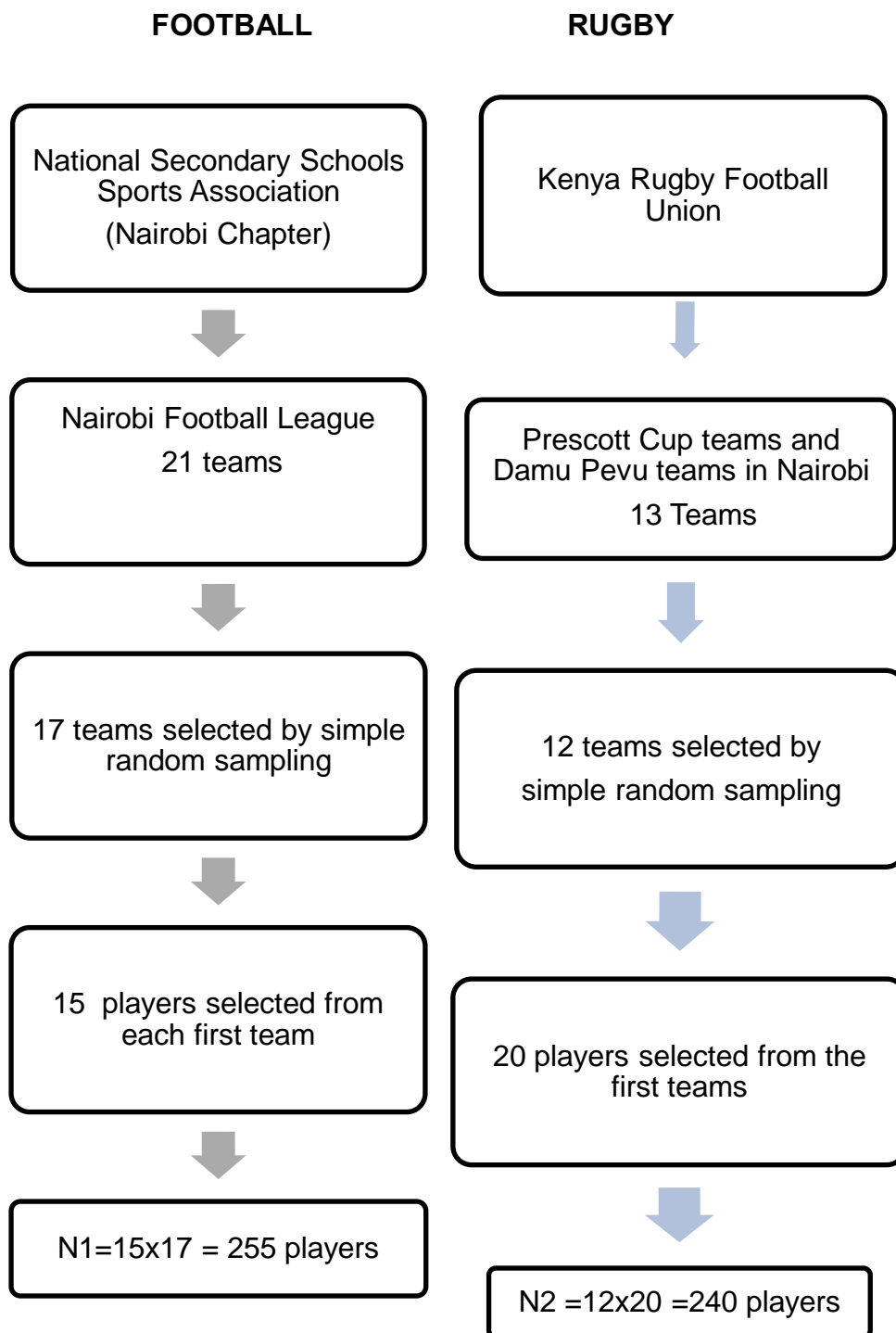
Z= Standard error of mean (Standard value of 1.96 at 95% confidence level)

d= degree of accuracy (freedom) desired, set at 0.05 in the study.

## **2.5 SAMPLE PROCEDURE**

Nairobi City County was conveniently sampled as it had the greatest number of schools that are active in both football and rugby in comparison to the other 46 Counties of Kenya. The study population was obtained through stratified random sampling of the schools that participated in rugby and football or both in Nairobi City County as shown in Figure 1. The 12 schools that were sampled for rugby included: Ofafa Jericho Secondary school, Strathmore School, Lenana School, St. Mary's School, Moi Forces Academy, Aquinas High School, Dagoretti High School, Nairobi School, Jamhuri High School, Muhuri Muchiri Secondary School, Upper Hill High School and Highway Secondary School. Whereas, 17 schools were sampled for football: Upper Hill High School, Ofafa Jericho, Olympic mixed secondary School, Jamuhuri High, Lavington Secondary, Moi Forces Academy, Muhuri Muchiri Secondary, Makongeni Secondary, Kamukunji Secondary, Strathmore School, St Mary's School, Nairobi School, Aquinas High School, Dagoretti High School, Highway Secondary School, Lenana School and Langata High school. These were both private and public high schools.

Athletes who participated in rugby or football in the selected school and were in the first team were recruited into the study through random sampling (Figure 1) following the set inclusion/exclusion criteria.



**Total sample size (N1+N2) = (255+240) = 495**

**Figure 1: Flow chart indicating the sampling procedure in this study**

In football, 15 players from the first team of each school were selected using simple random sampling; while in rugby 20 of the first team players were sampled.

However, if the first team (team A) players were absent on the day of data collection, the team B players were sampled. This represented 17 football teams and 12 rugby teams.

However, it is worth noting that during the data collection, the targeted participants in each sport in each school was either less or more than what has been represented in figure 1. This is due to the fact that in some schools it was difficult to get the students to participate in data collection either due to truancy or they were not available for sampling.

### **2.5.1 Inclusion Criteria**

1. Athletes who participated in rugby, football or both sports.
2. Male athletes aged 14-18 years of African descent,
3. Athletes who had obtained consent from their guardians or parents.
4. Athletes who assented.

### **2.5.2 Exclusion Criteria**

1. Students who did not assent to participate in the study.
2. Presence of developmental anomalies that weakened the tooth structure.
3. Children who were undergoing or had undergone orthodontic treatment

## **2.6 DATA COLLECTION AND ANALYSIS**

### **2.6.1 Data Collection Instruments and Technique**

The survey was based on a modified semi-structured interview questionnaire<sup>19</sup> (Appendix II) administered by the principal investigator. The names of the participants were not recorded. Only the team and position of the player were recorded so as to ensure anonymity and confidentiality. The study questionnaire

comprised of items including demographic data of the athlete, type of sports played by the athletes, duration of play in a particular sport, position of play, history of any dental hard and soft-tissues injuries sustained; such as tooth mobility (loosening of teeth), fracture of teeth and the jaw bones, soft tissue injuries on the face such as bruises and lacerations on lips, tongue or cheeks as result of sporting activity. The second part of the questionnaire comprised of questions on whether they had ever used a mouthguard while participating in sports and if not, the reasons why they did not use it and whether they thought mouthguards could protect one from dentofacial injury.

### **2.6.2 Oral Clinical Examination**

Clinical examination was done on 510 participants using a dental mirror, periodontal probe and disposable gloves under natural light in a classroom with the subject sitting upright on a chair. Appropriate infection control measures were practiced during examination of the participants. Traumatic injuries were categorized according to a modification of the WHO Oral Health Assessment Form 2013<sup>74</sup> (Appendix III) which was used to record the dental trauma status. In case a participant had more than one injury sustained while participating in different sports, the injuries were recorded.

### **2.6.3 Validity**

Pre-testing of the study instruments and tools was done and modifications made. The principal investigator was calibrated by one of the supervisor to calculate inter-examiner variability. The calibration was done at the School of Dental Sciences, University of Nairobi and at St Mary's School Nairobi during which period 20 students were used for calibration. A Cohen's Kappa score of 0.95 was obtained for

the clinical evaluation of the participants for trauma presence or absence. These showed good consistency and minimal variability.

#### **2.6.4 Reliability**

Pre-testing of the study instruments and tools was done and modifications made. Repeat examination procedures were done on every tenth subject to calculate intra-examiner reliability. A Cohen's Kappa score of 0.95 was obtained for clinical examination. This showed good consistency and minimal variability.

#### **2.6.5 Data Quality and Control**

The quality of data was ensured during the entire study process. At data collection point, completeness of questionnaires, legibility of data collected and validity of responses was determined. At the data processing, quality control included data cleaning and validation. All information collected was coded and password protected and the questionnaires arranged in folders and properly kept in lockable drawers for confidentiality.

#### **2.6.6 Data Analyses and Presentation**

This was done using computer software IBM SPSS – 22.0. (SPSS Inc, Chicago, Illinois, USA). Descriptive statistics and frequency distribution were determined and appropriate statistical tests were used to determine the association between two or more variables. Chi square test and Fisher's exact test were used to compare categorical variables within the study and Anova and Odds ratio were used to test association between variables. The information from this study was presented as frequency tables 2-15 and figures 2-8.

### **2.6.7 Control of Biases and Errors**

Only the respondents who met the set inclusion criteria were enrolled into the study. All data collection tools were pre-tested. All instruments used were calibrated.

## **2.7 ETHICAL CONSIDERATION**

Permission to carry out the study was obtained from the Kenyatta National Hospital and the University of Nairobi Ethics and Research Committee (Appendix IV). Permission was also obtained from the National Commission for Science, Technology and Innovation in Kenya (Appendix V). The investigator was under the supervision and guidance of the assigned supervisors. Informed consent was obtained from the parent/guardians of the students who participated in the study. The students assent was also obtained. Participation in the study was voluntary, and participants were at liberty to terminate their participation without any victimization. No invasive procedure was carried out during the course of this study. Confidentiality was maintained during data collection as the students included in the study were assigned numbers instead of their names and the data stored in a password protected computer. Advice and referral was provided to those who required further treatment. The findings of this study shall be shared with the parents/guardians, schools, unions and the Ministry of Sports and also could be used for the benefit of the society as a whole.



## CHAPTER THREE

### 3.0 RESULTS

#### 3.1 SOCIODEMOGRAPHIC CHARACTERISTICS

A total of 510 male students of African descent participated in the study. They were aged 14 years to 18 years with a mean age of 16.78 years  $\pm$  1.1 years. The athletes were sampled from 17 schools in Nairobi City County consisting of two private schools and 15 public schools. The highest mean age was 17.54  $\pm$  0.87 years while the lowest was 16.02  $\pm$  1.09 years ( $F = 7.85$ ;  $p = 0.00$ ). The participant's level of education varied with age. There was increase in age as the level of education increased ( $F = 151.02$ ;  $p = 0.00$ ) (Table 2).

The students were categorised as rugby players, football players, and those who participated in both sports (Table 3). Two hundred and fifty four (49.8%) of the participants played rugby, 220 (43.1%) played football while 36 (7.1%) played both sports. Most of the study participants (63.4%) were aged between 17 and 18 years. The average age of rugby players was 16.61  $\pm$  1.16 years whereas this was 16.95  $\pm$  1.04 years among football players. The mean age of football players was significantly higher than that of rugby players ( $F = 5.83$ ;  $p = 0.00$ ) in Table 3.

The participants duration of play in the various teams ranged from one year to a maximum of 13 years with football players (mean = 3.39 years) participating longer than rugby players (mean = 2.25 years). The mean duration of play of football and players who participated in both sports was significantly higher than that of rugby players ( $F = 61.35$ ;  $p = 0.00$ ) (Table 3).

**Table 2: Mean age of participants by level of Education**

Level of education	n	(%)	Mean age±SD
			(years)
Form One	66	12.9	15.21±0.99
Form Two	113	22.2	16.14±0.87
Form Three	196	38.4	17.04±0.73
Form Four	126	24.7	17.70±0.49
Post form Four	9	1.8	17.89±0.33
<b>Total</b>	<b>510</b>	<b>100</b>	<b>16.78±1.10</b>

**Table 3: Mean Age and Duration of Play of participants by sport**

TYPE OF SPORT	N	(%)	Mean age±SD (years)	F	P - Value
<b>Rugby</b>	254	(49.8)	16.61±1.16	5.83	0.00
<b>Football</b>	220	(43.1)	16.95±1.04		
<b>Both*</b>	36	(7.1)	16.94±0.92		

**Mean Duration of play by sport**

		Mean ±SD( Years)		
<b>Rugby</b>	254 (49.8)	2.28 ±1.14		
<b>Football</b>	220 (43.1)	3.66 ±1.65	61.35	0.00
<b>Both*</b>	36 (7.1)	3.47± 1.29		
<b>TOTAL</b>	<b>510 (100)</b>	<b>2.79 ± 1.43</b>		

\*Both means participants playing both Rugby and Football

**Table 4: Mean age of participants by Schools**

<b>SCHOOL</b>	<b>n</b>	<b>(%)</b>	<b>MEAN AGE</b>
Private High Schools	46	10.0	16.65±1.04
Public High Schools	464	9.6	16.79±1.11
<b>TOTAL</b>	<b>510</b>	<b>100</b>	<b>16.78±1.10</b>

**Table 5: Distribution of participants by school, age and sport**

<b>School</b>	<b>Total</b>	<b>Age(years)</b>					<b>Sport</b>		
		<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>Rugby</b>	<b>Football</b>	<b>Both*</b>
Public High Schools	<b>464</b>	14	53	101	143	153	236	207	21
Private High Schools	<b>46</b>	2	3	14	17	10	18	13	15
<b>Total (n)</b>	<b>510</b>	16	56	115	160	163	254	220	36
<b>Percentages</b>	<b>100</b>	<b>3.1</b>	<b>11</b>	<b>22.5</b>	<b>31.4</b>	<b>32</b>	<b>49.8</b>	<b>43.1</b>	<b>7.1</b>

Both\* means participants playing both Rugby and Football

### **3.2 PREVALENCE OF DENTOFACIAL INJURIES IN RUGBY AND FOOTBALL PLAYERS**

The self-reported prevalence of dentofacial trauma among the participants was 281 (55.1%) participants with the senior students (17-18 year olds) contributing to 185 (65.8%) injuries. The reported prevalence of injuries in each individual sports, was higher in participants playing both sports at 66.7%, followed by rugby at 54.3% and in footballers at 54.1%. This, however, was not statistically significant ( $\chi^2 = 2.09$ ,  $df = 2$ ,  $p = 0.35$ ) as shown in Table 6.

According to the clinical examination using the Modified World Health Organization Oral Health Assessment Form 2013, 199 (39.0%) participants showed evidence of

dentofacial trauma as a result of sporting activity with players who participated in both rugby and football having a statistically significant higher prevalence of injuries ( $\chi^2 = 7.49$ ,  $df = 2$ ,  $p = 0.02$ ) (Table 6). Therefore, the null hypothesis that there is no association between the type of contact sport and dentofacial injuries is rejected. Participants who had played sports for a period of between three and five years had the highest prevalence rates of injuries at 27.3% followed by those who had played for less than three years at 26.6% of the injured participants. Participants who had played for more than 11 years had the least prevalence rate of 7.8%.

The highest reported rate of dentofacial injury in an individual school was 84.6% while the lowest rate at 29.2%. The difference between the injury prevalence in different schools was significant ( $\chi^2 = 30.99$ ,  $df = 16$ ,  $p = 0.01$ ). The highest observed prevalence of injuries was at 53.4% while the lowest was at 23.4% (Table 7). Among private school participants, 60.9% reported having experienced dentofacial injury whereas in public schools, 54.5% had experienced dentofacial injury. Half of the private school participants were observed to have sustained dentofacial injuries while 37.9% of the public school participants were observed with one or more types of dentofacial injuries (Table 6).

**Table 6: Observed and Reported prevalence of dentofacial injury by Sport and Age**

Prevalence of dentofacial injury by sport							
DENTOFACIAL INJURIES							
TYPE OF SPORT	TOTAL	REPORTED		TEST	OBSERVED		TEST
		Yes n (%)	No n (%)		Yes n (%)	No n (%)	
Rugby	254 (100)	138 (54.3)	116 (45.7)		94 (37.0)	160(63.0)	
Football	220 (100)	119 (54.1)	101 (45.9)	$\chi^2 = 2.09$	83 (37.7)	137(62.3)	$\chi^2 = 7.40$
Both*	36 (100)	24 (66.7)	12 (33.3)	df = 2	22 (61.1)	14 (28.9)	df = 2
				p = 0.35			p = 0.02
<b>TOTAL</b>	510 (100)	281 (55.1)	229 (44.9)		199 (39.0)	311 (61.0)	
<b>Age (years)</b>							
14	16 (3.1)	7 (43.7)	9 (56.3)		6 (37.5)	10 (62.5)	
15	56 (11.0)	22 (39.3)	34 (60.7)	$\chi^2 = 9.17$	18 (32.1)	38 (67.9)	$\chi^2 = 3.91$
				df = 4			df = 4
16	115 (22.5)	67(58.3)	48 (41.7)	p = 0.06	52 (45.2)	63 (54.8)	p = 0.42
17	160 (31.4)	86 (53.7)	74 (46.3)		57 (35.6)	103 (64.4)	
18	163 (32.0)	99(60.7)	64 (39.3)		66 (40.5)	97 (59.5)	
<b>School</b>							
Private	46 (9.0)	28 (60.9)	18 (39.1)	$\chi^2 = 0.68$	23 (50.0)	23 (50.0)	$\chi^2 = 2.56$
Public	464 (91.0)	253 (54.5)	211 (45.5)	df = 1	176 (37.9)	288 (62.1)	df = 1
				p = 0.40			p = 0.10

Both\* means participants playing both Rugby and Football

**Table 7: Observed and Reported prevalence of dentofacial injury by School**

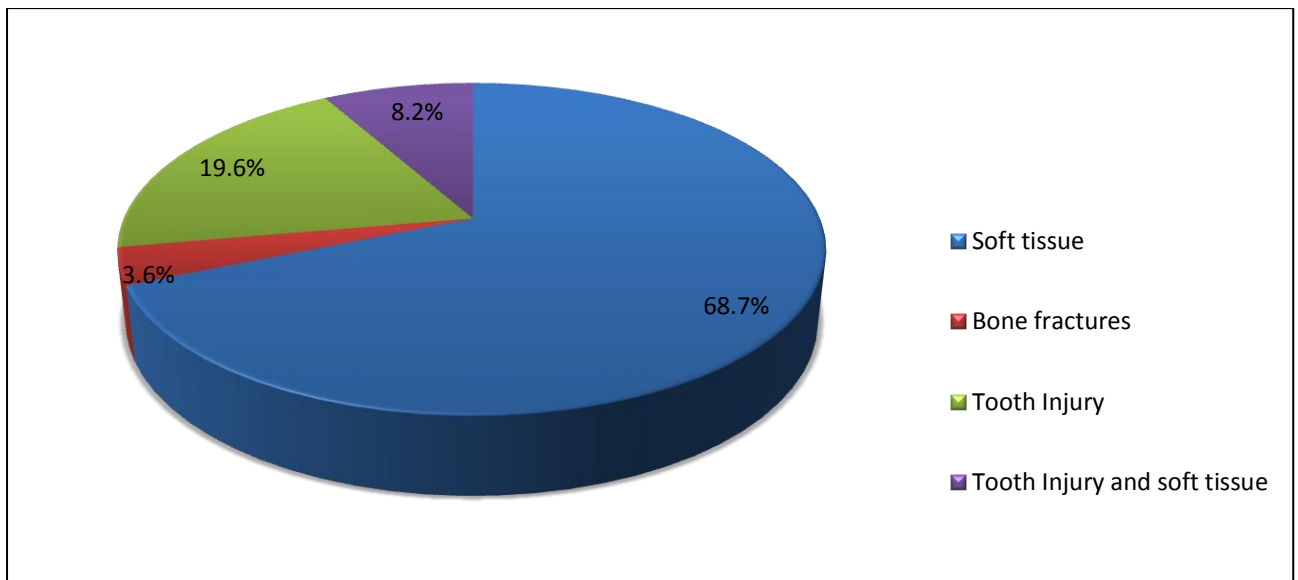
<b>DENTOFACIAL INJURIES</b>								
<b>SCHOOL</b>	<b>N</b>	<b>%</b>	<b>REPORTED n (%)</b>			<b>OBSERVED n (%)</b>		
			<b>YES</b>	<b>NO</b>	<b>TEST</b>	<b>YES</b>	<b>NO</b>	<b>TEST</b>
<b>A.H.S</b>	<b>51</b>	<b>10</b>	25 (49.0)	26 (51.0)		16 (31.4)	35 (68.6)	
<b>O.J.S.S</b>	<b>49</b>	<b>9.6</b>	31 (63.3)	18 (36.7)		18 (36.7)	31 (63.3)	
<b>M.M.S.S</b>	<b>48</b>	<b>9.4</b>	18 (37.5)	30 (63.5)		19 (39.6)	29 (60.4)	
<b>M.F.A</b>	<b>47</b>	<b>9.2</b>	18 (37.5)	30 (62.5)	$\chi^2 = 31$	11 (23.4)	36 (76.6)	$\chi^2 = 18$
<b>U.S.S</b>	<b>44</b>	<b>8.6</b>	31 (70.5)	13 (29.5)	<b>df = 16</b>	18 (40.9)	26 (59.1)	<b>df = 16</b>
<b>N.S</b>	<b>31</b>	<b>6.1</b>	16 (51.6)	15 (48.4)	<b>p = 0.01</b>	14 (45.2)	17 (54.8)	<b>p = 0.32</b>
<b>H.S.S</b>	<b>34</b>	<b>6.7</b>	19 (55.9)	15 (44.1)		19 (55.9)	15 (44.1)	
<b>J.H.S</b>	<b>30</b>	<b>5.9</b>	13 (43.3)	17 (56.7)		8 (26.7)	22 (73.3)	
<b>D.H.S</b>	<b>24</b>	<b>4.7</b>	7 (29.2)	17 (70.8)		8 (33.3)	16 (66.7)	
<b>St .M.S</b>	<b>24</b>	<b>4.7</b>	15 (62.5)	9 (37.5)		12 (50.0)	12 (50.0)	
<b>S.S</b>	<b>22</b>	<b>4.3</b>	13 (59.1)	9 (40.9)		11 (50.0)	11 (50.0)	
<b>K.S.S</b>	<b>22</b>	<b>4.3</b>	12 (54.5)	10 (45.5)		10 (45.5)	12 (54.5)	
<b>L.S</b>	<b>21</b>	<b>4.1</b>	16 (76.2)	5 (23.8)		9 (42.9)	12 (57.1)	
<b>O.M.S.S</b>	<b>18</b>	<b>3.5</b>	8 (44.4)	10 (55.6)		6 (33.3)	12 (66.7)	
<b>L.M.S.S</b>	<b>17</b>	<b>3.3</b>	10 (58.8)	8 (36.7)		8 (47.1)	9 (52.9)	
<b>L.H.S</b>	<b>15</b>	<b>2.9</b>	8 (29.2)	7 (46.7)		5 (33.3)	10 (66.7)	
<b>M.S.S</b>	<b>13</b>	<b>2.5</b>	11 (84.6)	2 (15.4)		7 (53.8)	6 (46.2)	
<b>Total</b>	<b>510</b>	<b>100</b>	<b>281 (55.1)</b>	<b>229 (44.9)</b>		<b>199 (39)</b>	<b>311 (61)</b>	

$\chi^2 = 26.46$ ,  $df = 1$ ,  $p = 0.00$

\*AHS -Aquinas High School, O.J.S.S - Ofafa Jericho Secondary School, M.M.S.S-Muhuri Muchiri Secondary school, M.F.A-Moi Forces Academy, U.S.S-Upperhill High School, NS-Nairobi School, H.S.S-Highway Secondary School, J.H.S-Jamhuri High School, D.H.S-Dagoretta High School, St.M.S-Saint Mary's School, S.S.S-Strathmore School, K.S.S-Kamkunji Secondary School, L.S-Lenana School, O.M.S.S-Olympic Mixed Secondary School, L.M.S.S-Lavington Mixed Secondary school, L.H.S-Langata High School, M.S.S-Makongeni Secondary School

### 3.3 TYPES OF DENTOFACIAL INJURIES AS REPORTED BY PARTICIPANTS

Dentofacial trauma reported by the players was divided into five broad categories: injuries of the soft tissues, bone, and tooth, combination of tooth and soft tissues and combination of tooth tissues, soft tissues and bone. The 281 (55.1%) injured participants had experienced different types of injuries. Soft tissue injuries contributed to 68.7% of the injuries followed by tooth injuries at 19.6% and lastly bone fractures which were 3.6% of the total dentofacial injuries. Some participants reported combination injuries involving the tooth and soft tissue which represented 8.2% of the injuries (Figure 2). The occurrence of different types of dentofacial injuries by sport was not statistically significant ( $\chi^2 = 1.32$ ,  $df = 2$ ,  $p = 0.52$ ) (Table 8).



**Figure 2: Types of dentofacial injuries as reported by the participants**

Soft tissue injuries were reported by 193 (68.7%) out of 281 participants. About half of these 99(51.3%) were reported by rugby players, 79 (40.9%) by football players while only 15 (7.8%) who played both sports reported soft tissue injury. Tooth injury accounted for 55 (19.5%) of the reported injuries. More than half of these injuries, 29 (52.7%) were reported by football players, 22(40%) by rugby players while only four

(7.3%) were reported by those who play both sports. The combination injury of tooth and soft tissue injury were reported by 23 (8.2%) out of 281 participant with rugby players reporting 10 (43.5%), football players reported nine (39.1%) while those who played both sports had reported four (17.4%) of combination injuries. Facial bruises accounted for 46.7 % of soft tissue injuries while cuts on lip, tongue or cheek were 53.3%. The reported hard tissue injuries were tooth mobility at 56.5%, fractured teeth at 37.9% and bone fractures at 5.6%.

Bone fractures were the least reported injuries with rugby players accounting for 70% of those who reported and footballers accounting for 20% of bone fractures.

Those who played both rugby and football reported the least bone fracture at 10% (Table 8).

### **3.3.1 Reported dentofacial injuries in Rugby**

There were 254 participants who played rugby alone. Of these 254 participants, 138 (54.3%) rugby players reported at least one type of dentofacial injury (Table 6). Ninety nine (71.7%) of the injured rugby players had sustained soft tissue injuries, 22 (15.9%) dental trauma, 10 (7.3%) had a combination of tooth and soft tissue injury and seven (5.1%) had bone injuries (Table 8). One hundred and fifteen players (44.7%) reported cuts on the cheek, lip or tongue, 112 (43.6%) players reported facial bruises, 36 (14%) tooth mobility and 13 (5%) players a fractured tooth.

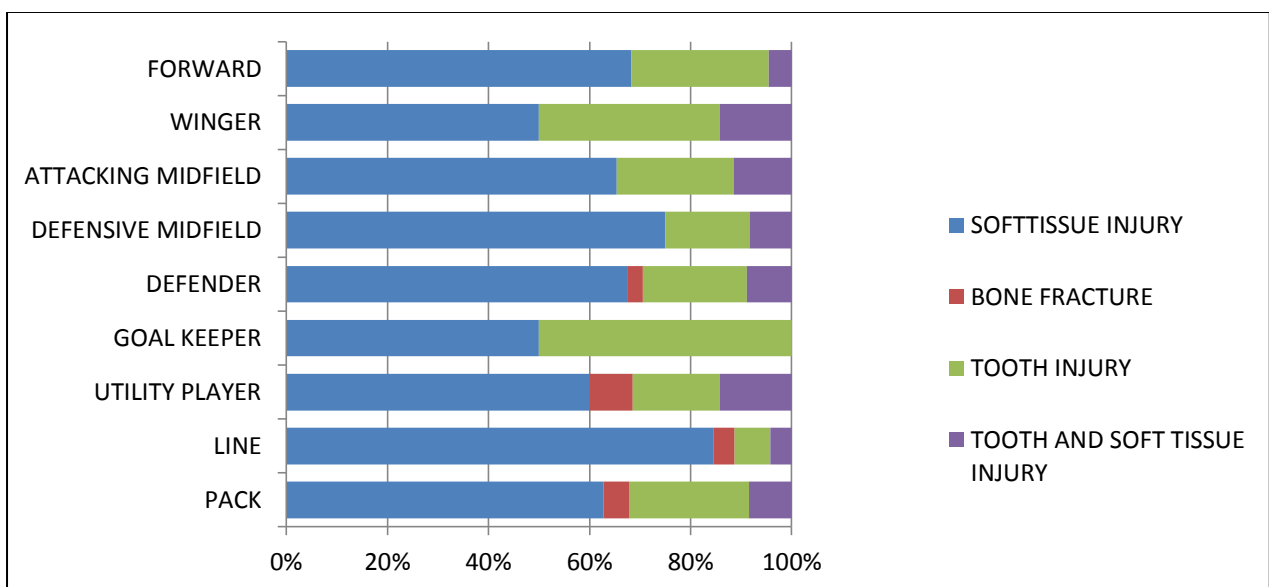
With regards to injuries by position of play, the line players in rugby sustained more soft tissue injuries than the pack players. However, the pack players sustained more hard tissue injuries compared to line players (Figure 3).



**Table 8: Distribution of types of Dentofacial injuries as reported by participants in each sport**

Type of Dentofacial injury	Type of Sport						Total	Test	
	Rugby		Football		Both*				
	n	%	n	%	n	%			
<b>Hard and Soft tissue injury by sport</b>									
<b>Soft tissue</b>	99	71.7	79	66.4	15	62.5	193	68.7	$\chi^2 = 1.32$ df = 2 p = 0.52
<b>Hard Tissue</b>	39	28.3	40	33.6	9	37.5	88	31.3	
<b>Types of dentofacial injuries by sport</b>									
<b>Soft tissue</b>	99	51.3	79	40.9	15	7.8	193	68.7	$\chi^{2*} = 7.34$ p=0.26
<b>Tooth</b>	22	40.0	29	52.7	4	7.3	55	19.6	
<b>Tooth and soft tissue</b>	10	43.5	9	39.1	4	17.4	23	8.2	
<b>Bone fractures</b>	7	70.0	2	20.0	1	10.0	10	3.6	
<b>Total</b>	138	49.1	119	42.4	24	8.5	281	100	

$\chi^{2*}$ = Fischer exact test, Both\* means player playing both Rugby and Football



**Figure 3: Distribution of different types of injuries in relation to position of play**

### **3.3.2 Reported dentofacial injuries in Football**

There were 220 participants who played football alone. Of these 220 participants, 119 (54.1%) football players had experienced at least one type of dentofacial injury (Table 6). Seventy nine (66.3%) of the injured football players had sustained soft tissue injuries, 29 (24.4%) players had sustained dental trauma, eight (6.7%) had a combination of tooth and soft tissue injury and two (1.7%) had bone injuries. One player had a combination injury of hard, soft and dental injury (Table 8).

Of these participants, 45.6% players had cuts on the cheek, lip or tongue, 34.5% players had facial bruises 13.0% players had a fractured tooth and 13.4% of the players had tooth mobility.

### **3.3.3 Reported dentofacial injuries by participants who play both Football and Rugby**

There were 36 participants who played both rugby and football. Of these 36 participants, 24 (66.0%) players reported having sustained at least one type of dentofacial injury (Table 6). Fifteen (62.5%) of the injured players had soft tissue injuries while nine players (37.5%) had at least one type of hard tissue injury (Table 8). Eight (22%) of the players had experienced tooth mobility, six (15.5%) players had fractured tooth, 16 (44%) players had experienced facial bruises and 23 (65%) had experienced cuts on the cheek, lip or tongue (Table 8).

## **3.4 DENTOFACIAL INJURIES FROM CLINICAL EXAMINATION**

There were 510 participants who were examined. One hundred and ninety nine (39%) injured participants were observed to have experienced different types of dentofacial injuries. Rugby had the highest number of observed injuries at 18.4% followed by football at 16.3%. One hundred and sixty four (32.2%) players had hard tissue injuries, 17 (3.3%) had soft tissue injuries and 18 (3.5%) had combination injuries. The commonest type of injury observed was enamel infraction at 28.3%, followed by enamel fracture at 21.4% and enamel and dentine fracture at 10.2%. The least observed injury was tooth mobility at 1.5% (Table 9).

### 3.4.1 Observed dentofacial injuries in Rugby

There were 254 rugby players who were examined. Ninety four (37.0%) players were observed to have sustained dentofacial injuries (Table 6). Seventy six (29.9%) had hard tissue injuries, nine (3.5%) players soft tissue injuries and nine (3.5%) combination injuries. Enamel infraction was the most common type of observed dental injury at 29.1%, followed by enamel fracture at 19.4%. Avulsion and tooth mobility were the least observed injuries (Table 9).

The maxillary right central incisor had the highest frequency of injuries at 28.9% followed by the maxillary left central incisor at 24.3% (Figure 4).

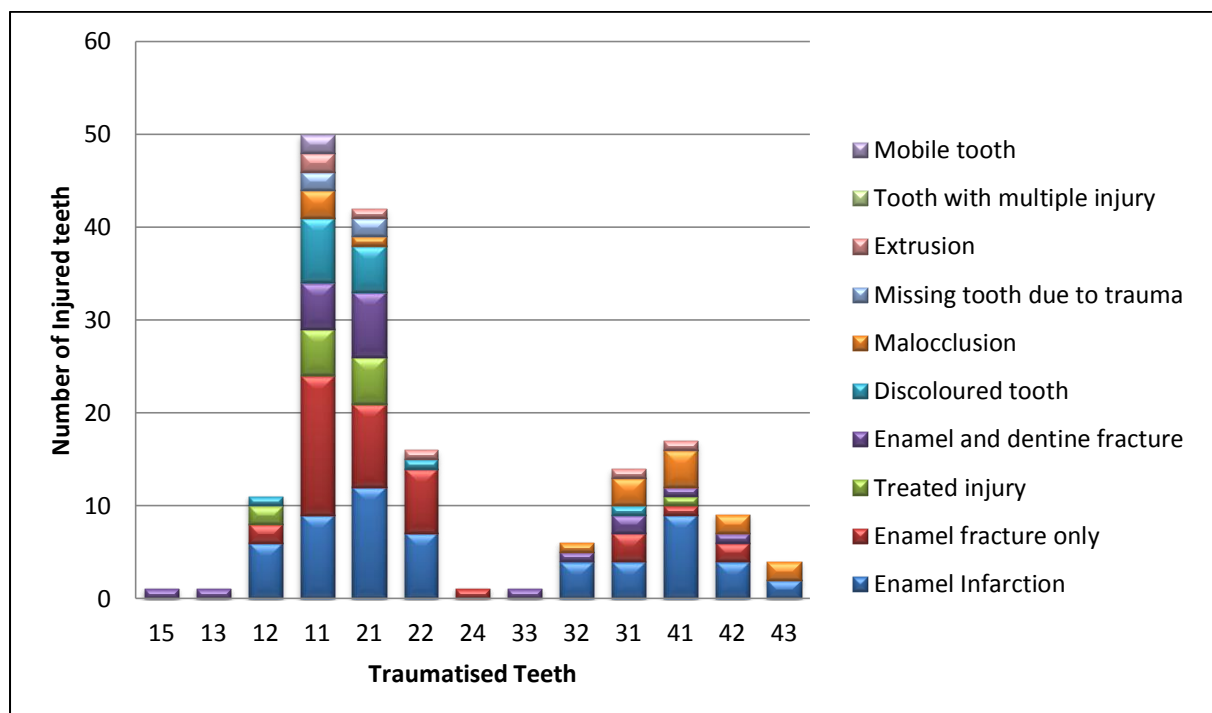
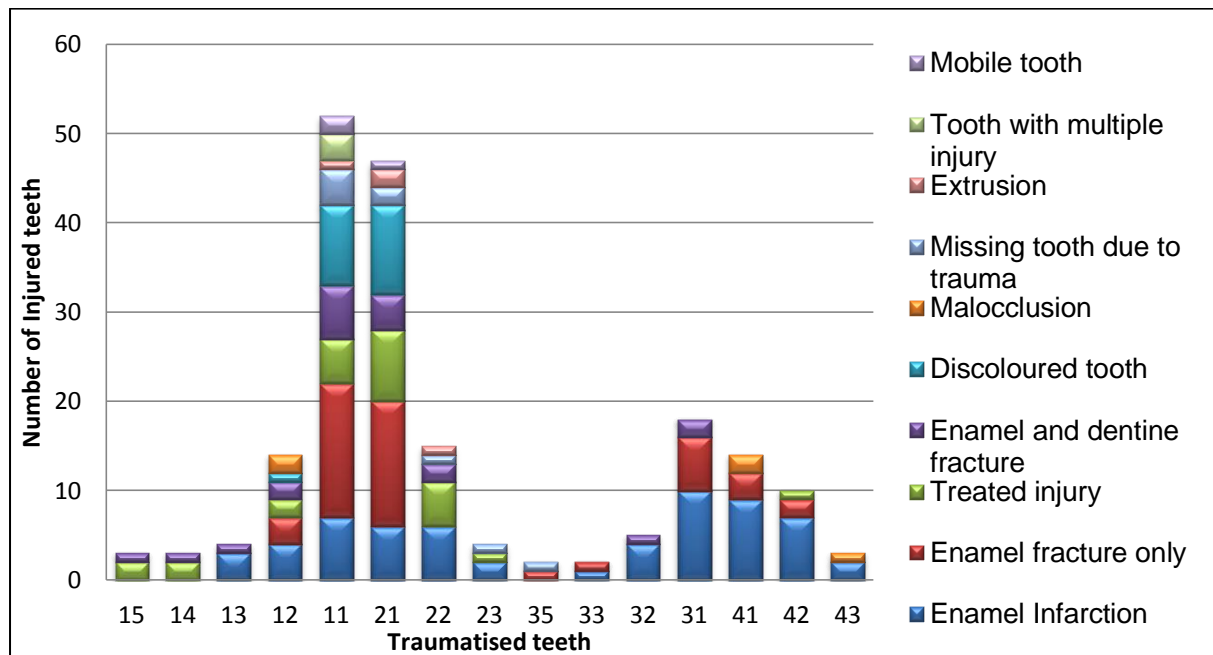


Figure 4: Distribution of dentofacial injuries as observed per tooth in Rugby

### 3.4.2 Observed dentofacial injuries in Football

There were 220 football players who were examined. Eighty three (37.7%) players had sustained injuries while playing football (Table 6). Sixty eight (30.9%) players had hard tissue injuries, eight (3.6%) had soft tissue injuries and 7 (3.2%) had combination injuries. Sixty (28.6%) players had enamel infraction, 45 (21.4%) had enamel fracture and twenty nine (13.8%) had treated injuries (Table 9).

The maxillary right central incisor had 26.3% injuries while the maxillary left central incisor had 23.3% injuries (Figure 5).



**Figure 5: Distribution of dentofacial injuries as observed per tooth in Football**

### 3.4.3 Observed dentofacial injuries in participants who play both rugby and football

Thirty six participants who played both Rugby and Football were examined. It was observed that 22 (61.1%) of the participants had sustained dentofacial injuries. Twenty (55.6%) had hard tissue injuries and two (5.6%) had combination injury. No athlete who played both Rugby and Football had soft tissue injury by itself. The commonest type of injury observed was enamel fracture at 28.3%, enamel infraction at 24.5%, enamel and dentine fracture at 17.0% and discoloured teeth at 9.4%. The least observed injury in this group was extrusion which was not observed (Table 9).

**Table 9: Types of observed dentofacial injuries by sport**

Type of injury	Type of sport			Total number of observed injuries (n=459) n (%)
	Rugby (n=196)	Football (n=210)	Both* (n=53)	
	n (%)	n (%)	n (%)	
<b>Enamel Infraction</b>	57 (29.1)	60 (28.6)	13 (24.5)	130 (28.3)
<b>Enamel fracture only</b>	38 (19.4)	45 (21.4)	15 (28.3)	98 (21.4)
<b>Treated injury</b>	14 (7.2)	29 (13.8)	4 (7.5)	47 (10.1)
<b>Enamel and dentine fracture</b>	18 (9.2)	16 (7.6)	9 (17.0)	43 (10.2)
<b>Discoloured tooth</b>	16 (8.2)	20 (9.5)	5 (9.4)	41 (9.3)
<b>Malocclusion</b>	17 (8.7)	6 (2.9)	1 (1.9)	24 (5.2)
<b>Avulsion</b>	4 (2.0)	9 (4.2)	1 (1.9)	14 (3.1)
<b>Extrusion</b>	7 (3.6)	4 (1.9)	0 (0.0)	11 (2.4)
<b>Tooth with multiple injury</b>	5 (2.6)	3 (1.4)	1 (1.9)	9 (2.0)
<b>Mobile tooth</b>	2 (1.0)	3 (1.4)	2 (3.8)	7 (1.5)
<b>Soft tissue injury only</b>	9 (4.6)	8 (3.8)	0	17 (3.70)
<b>Combination of soft and Hard tissue</b>	9 (4.6)	7 (3.3)	2 (3.8)	18 (3.9)

\*Players playing both Rugby and Football

### 3.5 AETIOLOGY OF DENTOFACIAL TRAUMA IN RUGBY AND FOOTBALL

The aetiology of dentofacial trauma of these two contact sport are described by the phase of play in this study (Figure 6). The most common cause of dentofacial injuries was collision (26.2%), tackling (19.7%), being tackled (18.0%), falling (7.8%), and landing (7.6%), heading and scrambling at 6.5% and 6.3% respectively. The least common causes of dentofacial trauma were shooting, turning, during a lineout and being hit by an object. Collision was the common cause of dentofacial injuries among rugby players (28.0%), followed closely by tackling (26.9%) while in football collision (27.4%) and being tackled (20.6%) were the major causes (Table 10). Out of the 281 players who reported having sustained a dentofacial injury, 153 (54.4%) injured players reported having sought first aid treatment. Forty seven percent received treatment at the pitch side and 26% received treatment at the hospital (Figure 7).

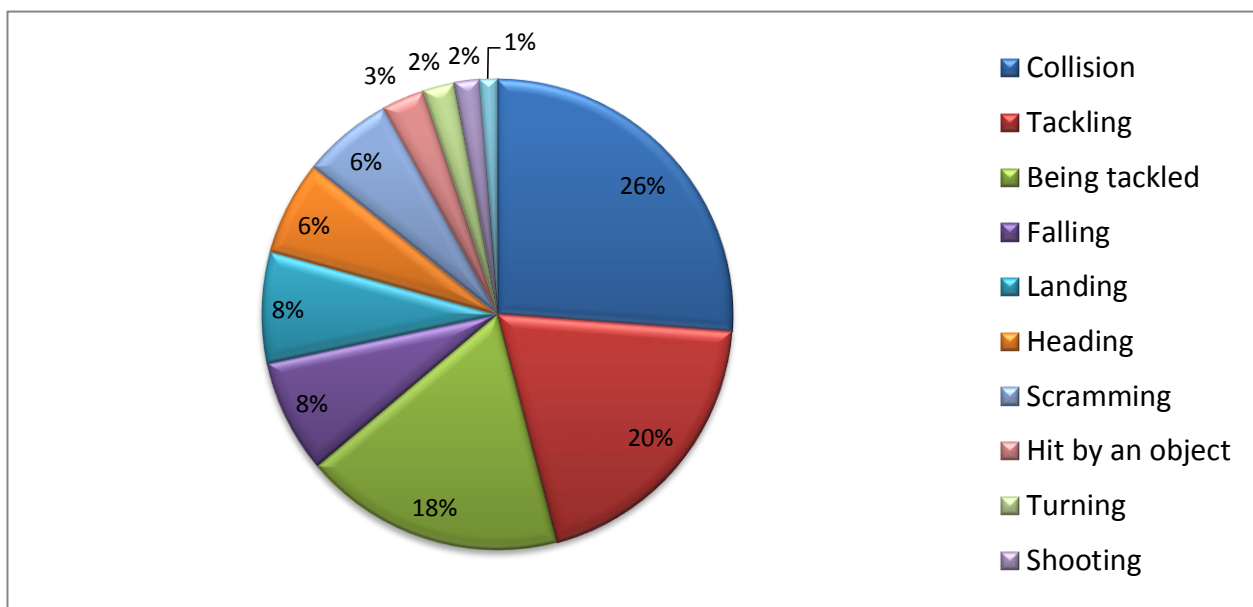
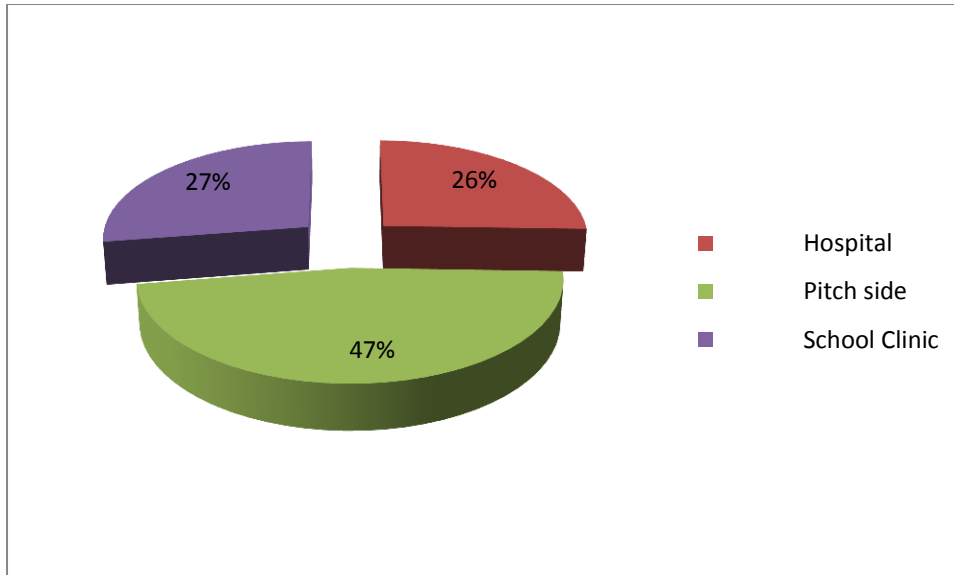


Figure 6: Causes of Dentofacial injuries during sporting activity

**Table 10: Injury by phase of play as a percentage of all injuries reported by sport**

Injury Mechanism	Type of sport							
	Rugby		Football		Both*		Total	
	n	%	n	%	n	%	n	(%)
<b>Collision</b>	72	28.0	48	27.4	14	17.5	134	(26.2)
<b>Tackling</b>	69	26.9	19	10.9	13	16.3	101	(19.7)
<b>Being tackled</b>	44	17.1	36	20.6	12	15.0	92	(18.0)
<b>Falling</b>	17	6.6	13	7.4	10	12.5	40	(7.8)
<b>Landing</b>	16	6.2	15	8.6	8	10.0	39	(7.6)
<b>Heading</b>	0	0	27	15.4	6	7.5	33	(6.4)
<b>Scramming</b>	23	9.0	0	0	9	11.3	32	(6.3)
<b>Hit by an object</b>	7	2.7	5	2.9	3	3.8	15	(2.9)
<b>Turning</b>	2	0.8	7	4.0	2	2.5	11	(2.1)
<b>Shooting</b>	1	0.4	5	2.9	3	3.8	9	(1.8)
<b>Lineout</b>	6	2.3	0	0	0	0	6	(1.2)

\*Players playing both Rugby and Football



**Figure 7: Site of first aid following dentofacial injury during play**

### **3.6 LEVEL OF AWARENESS AND EXTENT OF MOUTHGUARD USE IN RUGBY AND FOOTBALL**

A total of 350 (68.6%) players knew what a mouthguard was. Athletes playing rugby were more knowledgeable about mouthguards (81.9%) than athletes playing football (55.5%) and both sports (55.6%). The difference was statistically significant ( $\chi^2 = 41.3$ ,  $df = 2$ ,  $p = 0.00$ ). Two hundred and fifty (49.0%) were aware that mouthguards can prevent injuries. This was higher among rugby players than the other two groups as 60.2% of rugby players were aware that mouthguards confer protection to the athletes. This was statistically significant in comparison with the two other groups ( $\chi^2 = 29.2$ ,  $df = 2$ ,  $p = 0.00$ ). However, only 37 (7.3%) players used a mouthguard regularly while 68 (13.3%) used it occasionally. Sixty eight (26.8%) rugby players, 21 (9.6%) football players and 16 (44.3%) players who played both sports used mouthguards ( $\chi^2 = 36.45$ ,  $df = 4$ ,  $p = 0.00$ ) (Table 11a). There was a higher uptake of mouthguards by private school players (56.5%) than in public schools (17.0%).



The difference between the two types of school was statistically significant with private schools having a higher uptake than their public school counterparts ( $X^2 = 39.93$ ,  $df = 1$ ,  $p = 0.00$ ) (Table 11b).

Of the mouthguard users, more than three quarter 81 (77.1%) used the boil and bite mouthguard, 5 (4.8%) used the custom-made mouthguards and 4 (3.8%) used the stock mouthguard. A further 15 (14.3%) athletes did not know the type of mouthguards they were using (Table 12). Most of the mouthguard users wore their mouthguards during matches only (55.4%) and quarter (25.7%) of the users using their mouthguards throughout matches and training. The use of mouthguards during training and matches was highest among players who played both sports (Table 12). Mouthguard users mainly complained of speech difficulty (59%), breathing difficulty (16.1%) and dry mouth (9.5%) while using the device (Table 12). In relation to the type of mouthguard, custom-made mouthguard users mainly complained of dry mouth (80%) unlike the users who used the boil and bite and stock who mainly complained of speech difficulty (Table 13).

**Table 11a: Knowledge, awareness and use of mouthguards among study participants**

	Type of Contact sport			
	Rugby n=254 n (%)	Football n=220 n (%)	Both* n=36 n (%)	Total n=510 n (%)

**Do you know what a mouthguards is**

Yes	208 (81.9)	122 (55.5)	20 (55.6)	350(68.6)
No	46 (18.1)	98 (44.5)	16 (44.4)	160(31.4)

$\chi^2 = 41.3$  , df = 2, p = 0.00

**Awareness on mouthguards preventing dentofacial injury**

Yes	153 (60.2)	78 (35.5)	16 (44.4)	247(48.4)
No	101 (39.8)	142 (64.5)	20 (55.6)	263(51.6)

$\chi^2 = 29.2$  , df = 2, p =0.00

**Use of mouthguards**

Yes	27 (10.6)	5 (2.3)	5 (13.9)	37 (7.3)
Sometimes	41 (16.2)	16 (7.3)	11 (30.4)	68 (13.3)
No	186 (73.2)	199 (90.4)	20 (55.6)	405(79.4)

$\chi^2 = 36.45$  , df = 4, p = 0.00

Both\* means players playing both Rugby and Football

**Table: 11b Mouthguard use in Private and Public Schools**

	Type of School		$\chi^2$	p-value	
	Private n (%)	Public n (%)			
Use Mouthguard	Yes	26 (56.5)	79 (17.0)	39.93	0.00
	No	20 (43.5)	385(83.0)		

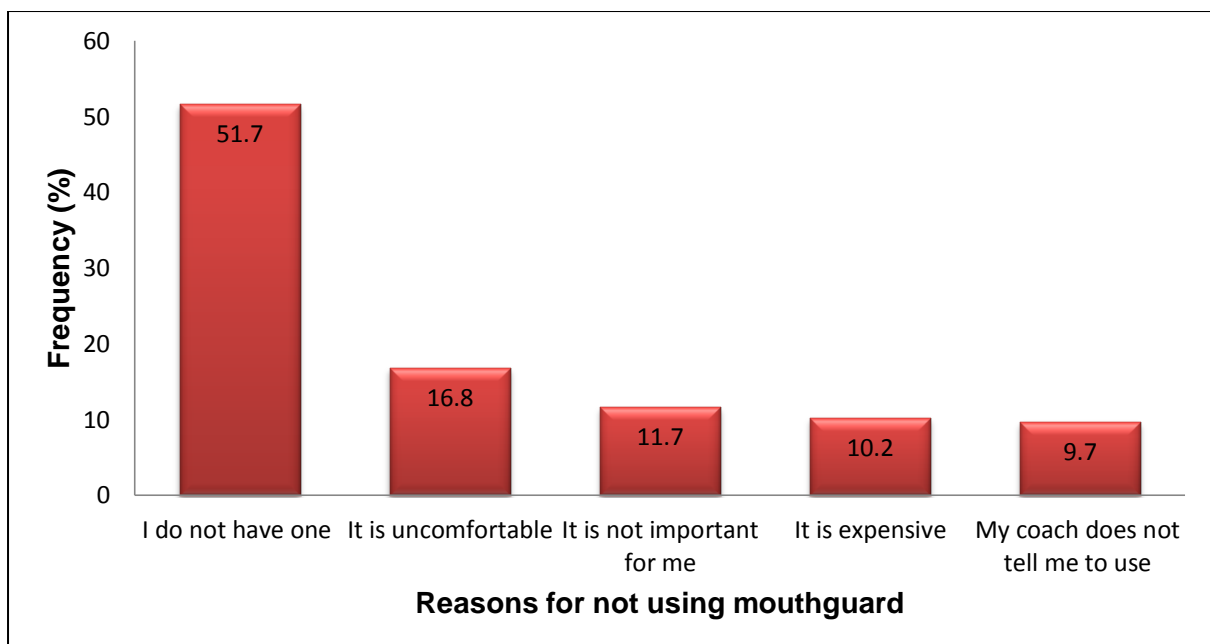
**Table 12: Type of Mouthguard, timing of mouthguard use and complaints while using mouthguards by sport**

	Type of Sport							
	Rugby (n=68)		Football (n=21)		Both (n=16)		Total (n=105)	
	n	%	n	%	n	%	n	%
<b>Type of Mouthguard worn</b>								
<b>Boil and Bite</b>	54	79.4	15	71.4	12	75.0	81	77.1
<b>Custom-made</b>	2	2.9	1	4.8	2	12.5	5	4.8
<b>Stock</b>	3	4.4	0	0.0	1	6.3	4	3.8
<b>Do not know</b>	9	13.2	5	23.8	1	6.3	15	14.3
<b>Timing of mouthguard use</b>								
<b>During matches</b>	43	16.9	7	3.2	5	13.9	55	55.4
<b>During matches and training</b>	13	5.1	5	2.3	9	25.0	27	25.7
<b>Sometimes</b>	12	4.7	9	4.1	2	5.6	23	21.9
Fishers exact test = 50.6 p =0.00								
<b>Complaints while using mouthguards</b>								
<b>Speech difficulty</b>	44	64.7	12	57.1	6	37.5	62	59.0
<b>Breathing difficulty</b>	10	14.7	2	9.5	5	31.3	17	16.2
<b>Dry Mouth</b>	5	7.4	2	9.5	3	18.8	10	9.5
<b>Bad taste and smell</b>	3	4.3	4	19.0	1	6.3	8	7.6
<b>No complaints</b>	6	8.8	1	4.8	1	6.3	8	7.6
Fishers exact test = 10.84 p =0.17								

**Table 13: Complaints while using a mouthguard by type**

Complaint	Type of Mouthguard			
	Stock n (%)	Boil and Bite n (%)	Custom made n (%)	Do not know n (%)
Speech difficulty	2 (50.0)	50 (61.7)	1 (20.0)	9 (60.0)
Breathing difficulty	0 (0.0)	15 (18.6)	0 (0.0)	2 (13.3)
Dry Mouth	1 (25.0)	3 (3.7)	4 (80.0)	2 (13.3)
Bad taste and smell	0 (0.0)	7 (8.6)	0 (0.0)	1 (6.7)
No complaints	1 (25.0)	6 (7.4)	0 (0.0)	1 (6.7)
<b>TOTAL</b>	<b>4 (3.8)</b>	<b>81(77.1)</b>	<b>5 (4.8)</b>	<b>15 (14.3)</b>

Two hundred and thirty four (51.7%) athletes stated that the reason they do not use a mouthguard is because they did not own one with a further 76 (16.8%) saying the device is uncomfortable. Forty four (9.7%) blamed their coaches for not telling them to use the device (Figure 8).



**Figure 8: Reasons for not wearing a mouthguard at all or sometimes**

### 3.7 MOUTHGUARD USE AND PREVALENCE OF DENTOFACIAL INJURIES

Among the mouthguards users, 40 (38.1%) players had sustained dentofacial injuries while using mouthguard as reported by the participants compared to 241 (59.5%) among the non-users of mouthguards. Non-users of mouthguards had a statistically significant higher prevalence of dentofacial injuries as compared to mouthguard users ( $X^2 = 15.45$ ,  $df = 1$ ,  $p = 0.00$ ) as shown in table 14. Therefore, the null hypothesis that there is no association between mouthguard use and prevalence of dentofacial injuries is rejected.

In rugby, 26 (38.2%) mouthguard users had experienced dentofacial injuries in comparison with 112 (60.2%) players who did not wear mouthguards. Non-users of mouthguards in rugby had a statistically significant higher prevalence of dentofacial injuries as compared to mouthguard users ( $X^2 = 9.69$ ,  $df = 1$ ,  $p = 0.00$ ) as shown in table 14.

In football, seven players (33.3%) had experienced injuries while wearing mouthguards in comparison with 112 (56.3%) players who did wear mouthguards. The non-users of mouthguards in football had a statistically significant higher prevalence of dentofacial injuries as compared to mouthguard users in the same sport ( $X^2 = 4.03$ ,  $df = 1$ ,  $p = 0.045$ ) as shown in table 14. Among the athletes who played both sports, seven players (43.8%) had experienced injuries while wearing mouthguards in comparison with 17 (85.0%) players who did not wear mouthguards. Non-users of mouthguards had a statistically significant higher prevalence of dentofacial injuries as compared to mouthguard users ( $X^2 = 6.81$ ,  $df = 1$ ,  $p = 0.01$ ) as shown in table 14. Hence there is an association between mouthguard use and

prevalence of dentofacial injuries in both sports as mouthguard users sustained fewer injuries as compared to non-users. This rejects the null hypothesis that there is no association between mouthguard use and prevalence of dentofacial injuries.

**Table 14: Association of dentofacial injuries between mouthguard users and non-users**

		Use mouthguard		$\chi^2$	<i>p-value</i>
		Yes <i>n</i> (%)	No <i>n</i> (%)		
<b>All study participants</b>					
<b>Injury while wearing a mouthguard</b>	Yes	40 (38.1)	241 (59.5)	15.45	0.00
	No	65 (61.9)	164 (40.5)		
<b>Rugby players</b>					
<b>Injury while wearing a mouthguard</b>	Yes	26 (38.2)	112 (60.2)	9.69	0.00
	No	42 (61.8)	74 (39.8)		
<b>Football players</b>					
<b>Injury while wearing a mouthguard</b>	Yes	7 (33.3)	112 (56.3)	4.03	0.045
	No	14 (66.7)	87 (43.7)		
<b>Both* sports</b>					
<b>Injury while wearing a mouthguard</b>	Yes	7 (43.8)	17 (85.0)	6.81	0.01
	No	9 (56.2)	3 (15.0)		

\*Both means those who play Rugby and Football

### **3.8 PATTERNS OF DENTOFACIAL INJURIES IN MOUTHGUARD USERS IN COMPARISON WITH THAT IN NON-USERS**

All the types of dentofacial injuries were reported in both mouthguard users and non-users. Mouthguard users had a lower chance of sustaining tooth injury, bone fractures and tooth and soft tissue injury as compared to non-users. However, 75% of the injured mouthguard users had sustained soft tissue injury which was higher than that in participants who did not use mouthguards (Table 15). Furthermore, both hard and soft tissue injuries that were sustained by athletes who did not use mouthguards were not statistically higher when compared to the same injuries sustained by athletes who used mouthguards ( $\chi^2 = 0.86$ ;  $df = 1$ ;  $p = 0.35$ ) (Table 15).

However, it is worth noting that mouthguard users had a lower occurrence of bone fractures (Odds ratio = 0.67 (0.08-5.36)), tooth injury (Odds ratio = 0.89 (0.36-2.05)) and a combination of tooth and soft tissue injury (Odds ratio = 0.57 (0.12-2.44)) when compared to athletes who did not use mouthguards while participating in sports. However, this was not statistically significant. The odds ratio of a soft tissue injury occurring was 1.44. In contrast, mouthguards users had a higher prevalence of soft tissue injuries than non-users but this was not statistically significant as the range lies between 0.67-3.10 and the  $p = 0.35$ .

**Table 15: Association between mouthguard use and Dentofacial injuries**

<b>Association between mouthguard use and dentofacial injury</b>					
<b>Mouthguard usage</b>					
<b>Type of Dentofacial injury</b>	<b>Total</b>	<b>Yes n (%)</b>	<b>No n (%)</b>	<b>ODDS RATIO</b>	<b>95% CI</b>
Soft tissue	<b>193</b>	30 (75.0)	163 (67.6)	1.44	(0.67-3.10)
Bone fractures	<b>10</b>	1 (2.5)	9 (3.8)	0.67	(0.08-5.36)
Tooth	<b>55</b>	7 (17.5)	48 (19.9)	0.89	(0.36-2.05)
Tooth and soft tissue	<b>23</b>	2 (5.0)	21 (8.7)	0.57	(0.12-2.44)
<b>Association between mouthguard use and hard and soft tissue injuries</b>					
Soft tissue	<b>193</b>	30 (75.0)	163 (67.6)	1.44	(0.67-3.10)
Hard tissue	<b>88</b>	10 (25.0)	78 (32.4)	0.70	(0.32-1.49)
<b>Total</b>	<b>281</b>	40(100.0)	241 (100.0)		

$\chi^2 = 0.86$ ; df = 1; p = 0.35



## CHAPTER 4

### 4.0 DISCUSSION

#### 4.1 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

The primary objective of this cross-sectional study was to determine the pattern of occurrence of sports - related dentofacial injuries and the awareness of mouthguards among 14-18 year old rugby and football players in Nairobi City County. The mean age of the participants in the present study was  $16.78 \pm 1.1$  years (Table 2). A Nigerian study by Onyeaso<sup>43</sup> in 2004 reported a slightly lower mean age of  $15.18 \pm 2.9$  years. This difference could be attributed to the lower age limit of 12 years that was sampled in the Nigeria study. The mean age of footballers was significantly higher than rugby players. Most players in both sports were in form three with a mean age of  $17.04 \pm 0.73$  years. This could be due to the fact that 17 year olds in form three are less busy hence suitable to be in the first team of each sport.

There having been no previous study carried out on dentofacial injuries and mouthguard use among rugby and football players in Kenya, several international studies have shown that the use of this protective devices does lower the occurrence of dentofacial injuries<sup>32,70,75</sup>. A sample size of 510 was selected from the participating schools to give a good representation of the students who play in the individual sport. The study sampled participants from only one county in a country of 47 counties hence may not give an exact picture of the nation at large. However, the sample could be seen as a good representation as this county houses people of diverse ethnic origins with varied responses, experiences and views. This could have shown the prevalence of dentofacial injuries; and the knowledge, awareness and use

of mouthguards in sports as these athletes were considered to be the most active in the studied sports. Furthermore, Nairobi County has a well organised sporting tournament in rugby and football than the other counties. The two contact sports were selected because they are the most popular sports in Kenya.

## **4.2 SPORTS-RELATED DENTOFACIAL TRAUMA**

Sports are a common cause of dentofacial injuries. These injuries or accidents often have lifelong consequences to the athlete and their caregiver. Although, there are several causes of dentofacial trauma, the present study investigated the prevalence of sports-related dentofacial injuries. In the present study, the reported prevalence of 55.1% was statistically significantly higher in comparison to the observed dentofacial injury which was 39.0% (Table 7). This could be as a result of healing especially soft tissue injuries between the time the injury occurred and data collection. Similar findings were reported among Japanese<sup>41</sup> students in 1998 where 43% of the students sustained dentofacial injuries while participating in rugby and football and in Nigeria where 57.9% of the athletes at a National sports fiesta had experienced dental injuries<sup>75</sup>. The observed (39%) prevalence of sports-related injuries was higher than a study done in India where 23.8% of the participants were observed to have sustained dental injuries while participating in various sporting activities<sup>76</sup>. The present study results contrasted a Kenyan study done by Muasya et al<sup>33</sup> that showed sporting activity accounted for 2.4% of all the traumatic dental injuries. The difference between Muasya's<sup>33</sup> study and the present study could be attributed to the younger age group they studied and the study did not focus on sports alone rather it investigated multiple causes of traumatic dental injuries in primary school children<sup>33</sup>.

In the present study, it was noted that with increase in the age of the interviewed participants, the higher the chance of the athlete to have had sustained a dentofacial injury. This could be because the duration of play or exposure of the athlete is increased hence higher chances of sustaining an injury. The competitive nature of the contact sport would mean that players take greater risks hence increased chances of contact with opposing teams and increased chance of sustaining dentofacial injuries<sup>22, 23, 63</sup>. It has been reported that most of sporting injuries occur among the adolescents and young adults and that occurrence of injuries decreases with age. This could be due to greater speed, increased competitiveness among young adults and increased height and weight<sup>21,22,23</sup>. However, with increase in age of professional players, the prevalence of TDI's tends to decrease as they are likely to have been trained on safer strategies of play in terms of tackling and fending off opposing players.

In rugby, the reported prevalence of dentofacial injuries was 54.3% while the observed prevalence was 37.0%. The observed figures were lower as the amount of recall bias had been reduced through a clinical examination. The observed injuries were the ones that were present at the time the study was been undertaken as soft tissue injuries which were reported could potentially have healed. In a study by Yamada et al<sup>41</sup>, 56.5% of the rugby players were reported to have sustained dentofacial injuries. Similar finding were reported in an Australian Study<sup>77</sup> among amateur Rugby Union players at 64.9% and in a study among high school rugby players in England who reported that 41% of them had experienced dentofacial injuries<sup>71</sup>. However, the rate of dentofacial injuries was higher in rugby players than football despite their higher levels of mouthguard awareness (81.9%) and usage

(26.8%).

In football, the reported prevalence of dentofacial injuries was 54.1% while the observed injury rates were 37.7%. In South Africa, 58.7% football players reported a past history of at least one type of dentofacial injury<sup>44</sup>. However, these findings of the present study differ with studies done in Brazil<sup>6</sup>, England<sup>16</sup> and Japan<sup>41</sup> where the reported prevalence of dentofacial injuries was 23.1%, 12.0% and 32.3% respectively. This could be due to the fact that in the three studies<sup>6,16,41</sup>, the athletes were more aware about the significance of mouthguard usage in protecting the oral tissues during sporting activity. The rules and regulations governing these sports were more enforced by the relevant authorities of their countries<sup>6,16,41</sup> and high level of development of the selected sports in these countries could have had an impact on the lower prevalence rates of dentofacial injuries.

With respect to the type of reported dentofacial injury, soft tissue at 68.3% was the most common type of reported dentofacial injury followed by hard tissue injuries at 19.5%, combination of hard and soft tissue at 8.1% and bone fractures at 3.9% (Table 8). These findings had the same pattern as a study done in India<sup>76</sup> where 55.8% sustained soft tissue but a higher number of the athletes (44.2%) participating in contact sports sustained hard tissue injuries. This could be attributed due to lack of mouthguard awareness and usage<sup>78</sup> and also the soft tissues cover the hard tissue and will be the first to be contacted when there is contact between players. Hence there is a higher chance of soft tissues being injured than hard tissues.

In the present study, more injuries were recorded on the maxillary incisors than the

mandibular incisors. In the maxilla, the central incisors had between 50.3% and 53.2% of all the dental injuries in both rugby and football. This is corroborated by previous reports that the maxillary incisors do sustain between 50 and 90 percent sports-related dental injuries<sup>31</sup>. However, dental injuries were also observed on the lower incisors to be between 16.1% and 17.9%. The lower injury rates in the mandibular teeth have been attributed to the fact that the existing relation between the maxilla and the cranial base is a rigid one yet that of the cranial base to mandible is not fixed. This allows better transmission of forces due to the mobility of the temporomandibular joint<sup>78</sup>. The high level of observed injuries to the right maxillary incisors could be attributed to the injury mechanism which was mainly through collision between athletes. Since most Kenyans are right handed, as shown in Kaisha's study<sup>79</sup> where majority (95%) of the participants sampled were right handed, the right side is considered the dominant side during play thus the right side would be more prone to injuries as players may approach each other from the dominant side. It could also be explained by the fact that during collision which was the phase of play when most injuries were sustained, players engaged more with their dominant side thus predisposing the right side to more injuries.

The commonest type of observed dentofacial injury was uncomplicated crown fracture which consists of enamel infraction, enamel fracture and enamel and dentine fracture. The observed rates were 63.9% (Table 9). Enamel infraction had the highest rates of 30.7% followed by enamel fracture at 23.1%. This is due to fact that the studied sports are aggressive in nature hence acute or even mild forces as a result of collision predispose one to trauma<sup>19, 28</sup>. This results in uncomplicated injuries. If the forces are high during contact, complicated injuries such as luxations,

avulsions and extrusion would be observed. The low level of complicated injuries is due to the fact that the studied participants are amateurs in their respective sports and may not be as aggressive as professionals.

In the present study, most of the injuries were as a result of collision (26.2%), tackling (19.7%), being tackled (18.0%) and falling (7.8%) (Table 10). Similarly, a Finnish study by Sane et al<sup>18</sup> on traumatic dental injuries in contact sports reported that the most common aetiology of dental injuries was collisions and tackles at 20.9%. In another study by Tin-Oo et al<sup>19</sup> in Malaysia, the common cause of injuries experienced by athletes was by collision between players, falling on their face and being hit by an object. In rugby and football, collision was the major cause of dentofacial injury at 28.0% and 27.4% respectively. Similar results were reported in a football study in Rwanda<sup>28</sup> where 24.2% of the injuries were as a result of collisions. This finding that collision was the leading cause of dentofacial injury is not surprising because rugby and football are collision sports as the body comes in to contact with other athletes or insentient objects.

#### **4.3 KNOWLEDGE, AWARENESS AND USE OF MOUTHGUARD**

The knowledge, awareness and use of mouthguard was investigated and reported. Knowledge on mouthguard in the present study was 68.6%. It was statistically higher among rugby players (81.9%) than football (55.5%) players. The reported rates of such awareness were 81.9% in Japan<sup>41</sup> and 82.8% in Nigeria<sup>75</sup>. Previous studies showed enormous discrepancies in different countries and in different sports. This included 100% awareness level in Germany and Switzerland<sup>32</sup> among handball players which is a ball sport as rugby and football, 52.4% in Brazil<sup>6</sup> in athletes

playing various sports including football, 27.0% in Israel<sup>58</sup> and 44.1% Turkey<sup>78</sup>. However, a study by Lang et al<sup>32</sup> showed that all athletes were familiar with mouthguards. Furthermore, the athletes appreciated the importance of this device in preventing injuries. With respect to the individual sports studied, similar trends were observed in Yamada's study that reported a higher level of awareness among rugby players at 93.7% compared to footballers at 72.5%<sup>41</sup>.

More rugby players knew about mouthguards in this present study due to the availability of information on mouthguards. It is possible that rugby as a sport in Kenya is considered to be an aggressive sport unlike football where the need for a mouthguard has not been emphasized and athletes themselves do not see the importance of mouthguards in football. However with the high levels of injuries reported and observed, use of mouthguards should be encouraged even in football by the relevant authorities.

The level of awareness that mouthguards can prevent injuries of all the athletes studied was 48.4%. The disparity between the level of awareness in this study and the above studies<sup>32,41</sup> could be related to the level of development of the above countries in terms of sports. This is because European nations are highly advanced in terms of facilities, level of education on safety, insurance cover and level of research into the field of sports medicine.

One hundred and five (20.6%) athletes in the present study reported that they used mouthguards. Out of 20.6%, only 7.3% used it frequently (Table 11a). This was statistically low considering that 55.1% of the athletes had reported dentofacial

injuries and a further 31.3% of the injured players sustained hard tissue injuries. Most of the athletes who claimed knowledge and awareness concerning the importance of using a mouthguard did not use the protective device as in previous studies<sup>41,69,70,71,75</sup>. Studies have shown that the use of mouthguard can minimize the occurrence of traumatic injuries to the anterior teeth especially the maxillary teeth<sup>32,64,71</sup>.

With regards to mouthguard use by sport, rugby players reported a higher usage (26.8%) than football players (9.6%). In rugby, similar findings were reported in a study in Japan<sup>41</sup> with 24.1% of the athletes wearing mouthguards. The slight difference can be attributed to the large sample size in Yamada's study compared to the present study. In a study by Boffano et al<sup>69</sup> in Italy, 53.9% respondents reported wearing a mouthguard during training and playing matches in rugby. The difference between the Italian study<sup>69</sup> and the present study (26.8%) could be attributed to the fact that Italy is a developed nation as it is a top tier team in rugby in terms of performance and rating as it is in the top six European Nations and more athletes are aware of the significance of mouthguards in protecting against dentofacial injuries.

In the present study (Figure 8), various reasons were given by athletes on why they did not wear mouthguard which could be related to other studies<sup>27,32,41</sup>. However, in football, previous studies<sup>6,41</sup> reported a lower range of 0.8% to 1.4% athletes who used mouthguards. This could be due to the fact that most of the football athletes did not own a mouthguard (51.7%) and did not see the importance of using the mouthguards (11.7%) during their sporting activity. This is similar to a Japanese



study<sup>41</sup> in which the footballers never saw it as a necessity to wear a mouthguard. Cost was reported as a stumbling block to mouthguard use by 10.2% (Figure 8) of the athletes unlike a study carried out in Malaysia<sup>19</sup>. Other reasons the athletes gave were that their coaches had not advised them to use the device (19.7%), it was uncomfortable (16.8%) and they did not own one (51.7%) either due to lack of knowledge of the device or awareness on that the device can be beneficial to them. The low uptake of mouthguards by football players was due to the fact that football players may not consider it to be a contact sport that could predispose them to injuries hence they do not see the need to protect themselves from dentofacial injuries.

The present study found that there were more mouthguard users in private schools than public schools. It has been shown that athletes from low socio economic groups show less tendency to use a mouthguard hence predisposing them to more dentofacial injuries. This could be due to lack of information or lack of proper sporting facilities in public school as compared to private schools that get more exposure to modern techniques.

Majority of the mouthguard users, 81 (77.1%) used the less superior boil and bite mouthguard as compared to five (4.8%) who used the custom-made ones. This can be due to the amateur state of the sports within Kenya, lack of awareness and failure of the relevant health and sporting bodies within the country to advocate for the use of these preventive devices. As shown in previous studies<sup>64,69</sup>, the cost factor or the perception that mouthguards especially the custom-made mouthguards are expensive could deter athletes from using them.

Mouthguard users had several complaints about the devices (92.4%). Most complaints arose from those who used boil and bite type of mouthguard (Table 13). These complaints included speech difficulty, breathing problems and dry mouth (Table 13). These reasons for not wearing a mouthguard could be due to “one’s perception” hence blaming this on its performance<sup>32</sup>. If more athletes used the custom-made mouthguards, less complaints of fit, comfort and difficulty in breathing would be reported<sup>61,62,72</sup>. According to Jennings study<sup>71</sup>, athletes should be motivated to use their mouthguards during training so as to encourage the habit and at the same time enable the athlete to breathe and speak with the device in the mouth so as to boost their confidence as the mentioned difficulties can be overcome during practice.

This present study has shown that statistically more athletes who did not use mouthguards had sustained dentofacial injuries (59.5%), which corroborates with other studies in Japan<sup>41</sup>, America<sup>56</sup> and Nigeria<sup>75</sup>. This supports the evidence that the use of mouthguard has a protective ability against dentofacial injuries. The mechanism of action of mouthguards is that it acts as a separator between the hard tissues which include the teeth and the soft tissues which include the lips and cheeks thus lowering the chances of a user experiencing soft tissue lacerations and opposing teeth from occluding traumatically. The mouthguards which act as protective devices offer a strong surface with the capability to spread and dissipate transmitted forces on impact<sup>57</sup>. A mouthguard works by “absorbing the impact energy and dissipating the remaining energy”<sup>58</sup>.

However, it is worth noting that even with a mouthguard in place, 38.1% of the participants who wore mouthguards still experienced dentofacial injuries with the commonest type of injury being soft tissue injury at 75.0% while 2.5% sustained bone fracture (Table 15). In the present study, the higher injury rates among mouthguard users could be attributed to the high number of athletes (77.1%) who use the boil and bite mouthguard which is considered to be less superior to the custom fabricated mouthguard. Similar findings were reported in England where 36% of the mouthguard users had sustained dentofacial injuries<sup>71</sup>. This is in line with previous studies<sup>70,75</sup> where a statistical difference was obtained on the injury rates between mouthguard users and non-users. As reported in previous studies<sup>41,70,75</sup>, the use of custom-made mouthguards which are fabricated by a dentist and have a less failure rate as compared to the boil and bite and stock mouthguards would lead to a reduction in the occurrence of dentofacial injuries among athletes.

Soft tissue injuries were significantly higher among mouthguard users compared to hard tissue injuries. This could be attributed to the competitive and aggressive nature of the two sports and that mouthguards do not protect participants from facial bruises and lacerations as it is an intraoral device<sup>55</sup>. Similar findings were reported in England<sup>71</sup> and Nigeria<sup>75</sup> where more soft tissue injuries were reported as compared to hard tissue injuries in the mouthguard users. From this present study it can be concluded that wearing a mouthguard would be beneficial to the athletes as the prevalence of dentofacial injury is reduced and from table 15, the prevalence of hard tissue injuries is lower in mouthguard users in comparison to non-users.

#### **4.4 LIMITATIONS TO THE STUDY**

1. Trauma experience was recorded based on clinical examination only. No dental radiographs were used.
2. Recall bias was a limiting factor in that some participants failed to remember when an injury occurred and/or what caused it.
3. Adhering to the random sampling was a challenge due to truancy or lack of consent and assent during data collection period.

## CHAPTER 5

### 5.0 CONCLUSION AND RECOMMENDATION

#### 5.1 CONCLUSION

The prevalence of dentofacial injuries in the present study while playing contact sports was 55.1%. Rugby players reported a higher prevalence of 54.3% and football players 54.1%. According to the clinical examination, 39.0% of the participants had experienced at least one type of dentofacial injury. Athletes who played both rugby and football had a statistically significant higher prevalence of dentofacial injuries as compared to those who played either rugby or football.

The most common type of dentofacial injury reported was soft tissue injuries at 68.3% followed by tooth injuries at 19.5%. This was replicated in the individual sports they being rugby and football.

Although the majority of the athletes (68.6%) knew what a mouthguard was, only a fifth of the athletes used the device. Fifty one percent reported that they did not own mouthguards while 16.8% said the mouthguards were uncomfortable hence the low rates of usage. Furthermore, only 7.3% of the participants used the mouthguards regularly. Majority of the participants used the boil and bite mouthguard (77.1%) compared to 4.8% who used custom-made mouthguards.

The prevalence of dentofacial injuries was significantly lower while wearing mouthguards ( $p=0.05$ ) and more rugby players experienced injuries while wearing mouthguards ( $p=0.00$ ) compared to football players ( $p=0.045$ ).

Both mouthguard users and non-users reported all types of dentofacial injuries with soft tissue injuries being higher than hard tissue injuries in mouthguard users. Mouthguard users had a lower occurrence of hard tissue injuries when compared to non-users.

## **5.2 RECOMMENDATION**

- There is need for increased efforts towards oral health campaigns and talks for greater use of mouthguards among athletes especially those involved in contact sports in Kenyan high schools.
- Athletes in contact sports should be trained on ways of protecting themselves during play so as lower chances of an injury occurring during active play.
- Schools curriculum should include sports medicine in order to educate students on potential injuries and modalities of preventing them.

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## **7.0 APPENDICES**

### **APPENDIX IA: CONSENT FORM (18 YEAR OLD)**

#### **DENTOFACIAL TRAUMA IN TWO CONTACT SPORTS AMONG HIGH SCHOOL STUDENTS IN NAIROBI CITY COUNTY**

##### **The purpose of the study**

I, Dr. Thomas Munyao Jr, from the University of Nairobi would like to seek your consent for your participation in a study aimed at determining the dental and orofacial injuries sustained while participating in either Rugby or football. The information I get is part of my research for a thesis as a partial fulfilment for the degree of Master of Dental Surgery in Paediatric Dentistry.

##### **How do you participate?**

I shall ask some questions about any injuries you have ever sustained on the face area and teeth and whether you use mouthguards, or know what they are. The examinations shall be carried out using clean (sterile) instruments and no invasive procedures shall be performed.

##### **Voluntary participation**

Your participation in the study is voluntary. You can terminate your participation in the study at will without any consequences. Also understand that the participation in the study does not entail any financial benefit.

##### **Anticipated risk**

There are no risks in this study since no invasive procedures are done.

##### **Confidentiality**

The information given to the researcher will be kept in strict confidence. No information, by which your identity can be revealed, will be released or published.

If you are satisfied with my explanation and you are willing to participate, please sign



the consent form.

**Consent form**

I.....of.....

Having understood the nature of study as explained to me by Dr. Thomas Munyao Jr of the University of Nairobi, is willing to participate in this study

**Name**.....**signed**.....**Date** .....

**Student (18 year old)**

**Declaration by the principal investigator**

I confirm that I have clearly explained the nature of the study to the participant and the expected benefits of this study and I have answered his questions regarding this research on the date of this consent form.

**Name**.....**Signed** .....

**P.I**

## **APPENDIX IB: CONSENT FORM (PARENTS AND GUARDIANS)**

### **DENTOFACIAL TRAUMA IN TWO CONTACT SPORTS AMONG HIGH SCHOOL STUDENTS IN NAIROBI CITY COUNTY**

#### **The purpose of the study**

I, Dr. Thomas Munyao Jr, from the University of Nairobi would like to seek your consent for your child's participation in a study aimed at determining the dental and orofacial injuries sustained while participating in either Rugby or football. I would also like to seek your consent for filling a questionnaire concerning the above.

#### **Objectives of the study**

The general objective of this research is to determine the pattern of occurrence of sports-related dentofacial injuries among athletes participating in Rugby and Football in Nairobi City County. The information I get is part of my research for a thesis as a partial fulfilment for the degree of Master of Dental Surgery in Paediatric Dentistry.

#### **Benefits**

Your child will receive free oral health education.

This study will form a baseline for future studies on prevalence of traumatic dental injuries in contact sports participants and their management. The results and recommendations of this study may be used to develop strategies on oral health education for students and athletes. The study will also serve as a partial fulfilment of a requirement of a Master of Dental Surgery degree in Paediatric Dentistry.

#### **What is your role?**

I shall ask some questions about any injuries your child has ever sustained on the face area and teeth and whether he uses a mouthguards, or knows what they are.

The examinations shall be carried out using clean (sterile) instruments and no invasive procedures shall be performed.

**Voluntary participation**

The participation of your child in the study is voluntary. You can terminate his participation in the study at will without any consequences. Also understand that the participation in the study does not entail any financial benefit.

**Anticipated risk**

There are no risks in this study since no invasive procedures are done.

**Confidentiality**

The information given to the researcher will be kept in strict confidence. No information about your child’s identity can be revealed, released or published. If you are satisfied with my explanation and you are willing to participate, please sign the consent form below.

**Role of Ethics and Research Committee**

This study conforms to international standards of medical research and has received the approval of the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee.

**Consent form**

I.....of.....

Having understood the nature of study as explained to me by Dr. Thomas Munyao Jr of the University of Nairobi is willing/not willing to have my child participate in the

study.

Name.....signed ..... Date .....  
Parent/guardian

**Assent information for the children**

My name is Dr. Thomas Munyao Jr from the University of Nairobi. I would like you to allow me to check your mouth to see if there are fractured (broken) teeth, missing teeth, and change in colour of the teeth, wounds in your mouth and bone fractures around your face. I will use a dental mirror and a probe to examine your teeth, gums and bones.

You should know that:

- You do not have to be in this study if you do not want to.
- You may stop being in the study at any time. If there is a question you don't want to answer, just leave it blank.
- Your parent(s)/guardian(s) were asked if it is okay for you to be in this study. Even if they say it's okay, it is still your choice whether or not to take part.
- You can ask any questions you have, now or later. If you think of a question later, you or your parents can contact me at the contacts provided.

**Sign this form only if you:**

- Have understood what you will be doing for this study,
- Have had all your questions answered,
- Have talked to your parent(s)/legal guardian about this project, and
- Agree to take part in this research

Signature .....Name ..... Date.....

\_\_\_\_\_  
Name of Parent(s) or Legal Guardian(s)

Researcher explaining study

Signature ..... Thomas Munyao Jr Date.....

**Declaration by the principal investigator**

I confirm that I have clearly explained the nature of the study to the participant and guardian and the expected benefits of this study and I have answered his questions regarding this research on the date of this consent form.

**Name**..... **Signed** .....**Date** .....

**The Principal Investigator**

DR THOMAS MUNYAO JUNIOR

School of Dental sciences, University of Nairobi

Tel:0723349504

**The supervisors**

DR. JAMES LWANGA NGESE, BDS (UON), MChD (UWC)

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School of Dental Sciences, University of Nairobi

Tel: 0714575258

KENYATTA NATIONAL HOSPITAL/ UON ETHICS AND RESEARCH COMMITTEE,

P.O.Box 20723 – 00202, Nairobi.

Tel:726300-9

**APPENDIX II: QUESTIONNAIRE (Modified questionnaire) <sup>19</sup>**

1. Athlete Number (code).....

2. Date of birth of athlete.....

3. a) Sex of participant M  F

b) Race

African Descent

Non-African descent

4. Education level

Form 1

Form 2

Form 3

Form 4

Other levels (specify).....

5. School.....

6. Type of sport you participate in

Rugby

Football

Both Rugby and Football

7. Which position do you play in your respective sport or both? .....

8. Period of time participating: \_\_\_ year(s) \_\_\_ month(s) in each sport mentioned

Rugby.....

Football .....

9. Have you ever visited a dentist before?

Yes  No

10a) Have you experienced any injury to your mouth, teeth or face while participating in contact sport?

Yes  No

b) If yes, what kind of injury and in which contact sport? (Soft tissues, bone fracture,

tooth injury)

.....

11. If you have experienced an injury on your mouth, teeth and face while participating in contact sports?

a) Did you have loosening of your tooth or teeth?

Yes  No

b) Did you have broken teeth?

Yes  No

c) Did you have broken bones of the face?

Yes  No

d) Did you have bruises on face?

Yes  No

e) Did you have cuts on lip, tongue or cheek?

Yes  No

12. How did you sustain your injury?

Collision

Tackled

Tackling

Falling

Landing

Turning

Heading

Shooting

Lineout

Scramming

Hit by an object

Not during sports/ non-sports related

13. a) Did you get any first aid treatment?

Yes  No

b) If yes where? .....

c) In your opinion, how costly are the life-long subsequent costs for a lost front tooth?.....

d) Do you have medical insurance?

Yes

No

I do not know

14. Do you know what a mouthguard is?

Yes  No

15. Are you aware that a mouthguard can prevent dental injury?

Yes  No

16. Do you use a mouthguard while participating in sports?

Yes  No  Sometimes

17. If yes, which type of mouthguard do you own?

- Stock
- Boil – and – bite
- Custom made
- Don't know

18. Have you ever gotten an injury while wearing a mouth guard?

Yes  No



19. When do you wear your mouthguard?

- During matches and training
- During matches
- During training
- Never
- Sometimes

20. Do you have any complaints while using a mouthguard?

- Speech difficulty
- Breathing difficulty
- Dry mouth
- Bad taste and smell
- Nausea (feeling of vomiting)
- Other.....

21. Why don't you use mouthguard?

- My coach does not tell me to use
- It is expensive
- It is uncomfortable
- It is not important for me
- I don't have one



**APPENDIX III: CLINICAL EVALUATION (DENTITION STATUS) CHART**

A. Dental trauma status (Modified World Health Organization Oral Health Assessment Form for Children, 2013)

0= no sign of injury

1= treated injury

7= jaw fracture

13 = Enamel Infraction

2= enamel fracture only

8= ulceration

3= enamel and dentine fracture

9= extruded tooth

4= pulp involvement

10= malocclusion

5= missing tooth due to trauma

11= mobile tooth

6= other damage

12= discoloured tooth

Number of teeth involved (state the condition with above key)

<b>15</b>	<b>14</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>
<b>45</b>	<b>44</b>	<b>43</b>	<b>42</b>	<b>41</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>

Others teeth (specify).....

B. Intervention Urgency

0= no curative

1= preventive or routine treatment needed

2= prompt treatment

3= immediate treatment due to pain or infection of dental and/or oral origin

4= referred for medical evaluation (systemic condition)

Number of teeth involved (state the urgency of required treatment according to above key)

<b>15</b>	<b>14</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>
<b>45</b>	<b>44</b>	<b>43</b>	<b>42</b>	<b>41</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>

Other teeth (specify).....

## APPENDIX IV: ETHICAL APPROVAL



UNIVERSITY OF NAIROBI  
COLLEGE OF HEALTH SCIENCES  
P O BOX 19676 Code 00202  
Telegrams: varsity  
(254-020) 2726300 Ext 44355



KNH/UON-ERC  
Email: uonknh\_erc@uonbi.ac.ke  
Website: www.uonbi.ac.ke



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P O BOX 20723 Code 00202  
Tel: 726300-9  
Fax: 725272  
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/50

9<sup>th</sup> February, 2015

Dr. Munyao Thomas Junior  
Dept. of Paediatric Dentistry and Orthodontics  
School of Dental Sciences  
University of Nairobi

Dear Dr. Munyao

**Research Proposal: Dentofacial Trauma in selected contact sports among high school  
Students in Nairobi City County (P566/09/2014)**


This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 9<sup>th</sup> February 2015 to 8<sup>th</sup> February 2016.

This approval is subject to compliance with the following requirements:

- a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN-ERC before implementation.
- c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN-ERC within 72 hours of notification.
- d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN-ERC within 72 hours.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- g) Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN-ERC website [www.erc.uonbi.ac.ke](http://www.erc.uonbi.ac.ke)

Yours sincerely

  
**PROF. M. L. CHINDIA**  
**SECRETARY, KNH/UON-ERC**

- c.c. The Principal, College of Health Sciences, UoN  
The Deputy Director CS, KNH  
The Assistant Director, Health Information, KNH  
The Chairperson, KNH/UON-ERC  
The Dean, School of Dental Sciences, UoN  
The Chairman, Dept. of Paediatric Dentistry and Orthodontics, UoN  
Supervisors: Dr. James Lwanga Ngesa, Dr. Marjorie Muasya

## APPENDIX V: RESEARCH AUTHORIZATION



### NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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9<sup>th</sup> Floor, Utalii House  
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P.O. Box 30623-00100  
NAIROBI-KENYA

Ref. No.

Date:

13<sup>th</sup> April, 2015

**NACOSTI/P/15/8920/5688**

Dr. Thomas Munyao Junior  
University of Nairobi  
P.O. Box 30197-00100  
NAIROBI.

#### RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *“Dentofacial trauma in selected contact sports among high school students in Nairobi City County”* I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for a period ending **31<sup>st</sup> August, 2015**.

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

  
**DR. S. K. LANGAT, OGW**  
**FOR: DIRECTOR GENERAL/CEO**

Copy to:

**COUNTY COMMISSIONER**  
**NAIROBI COUNTY**  
The County Commissioner P. O. Box 30124-00100, NBI  
Nairobi County. TEL: 341666

The County Director of Education  
Nairobi County.

