MANDIBULAR FRACTURES CAUSED BY SPORTS: A DESCRIPTIVE CLINICAL STUDY OF 72 PATIENTS MANAGED IN A TERTIARY HEALTH FACILITY.

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ABSTRACT

BACKGROUND: There is need to understand the nature of sports-related traumatic injuries to the oro-facial region in an environment due to increasing popularity of sports.

OBJECTIVE: To report the prevalence, characteristics, treatment approach and outcome of mandibular fractures sustained through sports.

PATIENTS AND METHODS: This is a descriptive clinical study that evaluated mandibular fractures sustained during sports over 10 years. The data analyzed were age, sex, occupation, mechanism of injury, site, concomitant injuries, and monthly/yearly distribution of patients, treatment and complications.

RESULTS: The prevalence of sports related mandibular fractures over the 10 year period was 72 (7.4%) patients who had 79 (5.7%) different fractures. This prevalence was optimum in the month of July and in the year, 2012. The male to female ratio was 11:1. Their ages ranged from 16-31 years but majority (76.4%) were between 20 to 27 years (P=0.001). The frequency of patients was less in the first five years (43.1%) when compared with the subsequent five years (56.9%) of the ten-year study period (P=0.03). Football related injuries in patients (87.5%, P=0.000) were the most common cause. Concomitant injuries occurred in 23 (32.0%) subjects, and these were mostly cerebral concussion (n=13, 18.1%). The methods of treatment utilized to manage the patients were conservative (n=10, 13.9%) and closed reduction (n=62, 86.1%). Limitation of mouth opening was complication in 3 (4.2%) patients treated by inter-maxillary fixation and these were corrected during follow-up.

CONCLUSION: Although the treatment outcome was good, this study has shown an increasing trend in the occurrence of mandibular fractures.

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INTRODUCTION

Mandibular fractures due to injuries to the face are particularly prevalent in contact and collision sports such as football, rugby, judo, karate, sumo, American football, boxing, ice hockey as well as in winter sports like snowboarding and skiing. [1-6] Popular sports vary from country to country, and the actual prevalence (range 0.3-43.0%) of sports related mandibular fractures differs depending on where the study was carried out, the duration or period covered by the investigation and the type of the popular sports within the environment among other confounding variables. [2, 4, 7, 8, 9] However, with the increasing popularity of sporting events worldwide due to the need to promote cordial relationships between countries, economic reasons, increases in free time among the younger age groups, and the introduction to more dangerous sports like mixed martial arts, greater attention has been paid to sports-related facial injuries. [7-9]

There is a need to understand the nature of these sports-related traumatic injuries to the oro-facial region in a particular environment to guide healthcare planners and sports administrators in making appropriate informed decisions. The most common fractures of the facial bone related to sports are those involving the mandible, nose, zygoma and orbital floor. [8, 10-12] The authors' observed that athletes in the study environment like in other parts of Nigeria do not wear protective gears like mouth guard and headgears during sports. Consequently, ensuring appropriate sports-related oral and maxillofacial injury management becomes necessary as the number of athletes grows; the dental surgeons and oral and maxillofacial surgeons need to have sufficient knowledge of the nature of the injuries to the mandible. This study, evaluated the fractures of the mandible sustained through sports over ten years in a tertiary health institution.

PATIENTS AND METHODS

This is a descriptive clinical study that evaluated mandibular fractures and the associated concomitant injuries sustained during sports. The study was carried out at the Dental and Maxillo-facial Surgery Clinic of the tertiary health institution between January 2006 and December 2015. Ethical approval was obtained from the Research and Ethics Committee of the hospital before the commencement of the study, which followed the 1975 (as revised in 2008) Declaration of Helsinki on Medical Protocol and Ethics, and written informed consent was obtained from all the subjects before being enrolled in the study.

Inclusion criteria were patients of all ages, both male and female that sustained mandibular fractures from sports, were completely or partially dentate, and kept a minimum of six follow-up appointments. Patients that were edentulous, had isolated dento-alveolar fractures of the mandible, and those with debilitating medical and surgical conditions that would interfere with wound healing were excluded. Also excluded from the study were patients on steroid/oral contraceptives therapy, and those who take or use substances like narcotics, tobacco and alcohol.

After clinical evaluation of the patients, plain radiographs relevant to mandibular fractures were obtained to confirm the fractures. When necessary, pre and post-trauma photographs and study models were utilized to aid treatment planning and assess treatment outcome. The oral hygiene status of the patients was assessed and graded using Gross Plaque Scoring Method (+ = Good, ++ = Fair, +++ = Poor).

The patients were treated under the same protocol. Those patients whose fractures were favorable and not displaced were treated conservatively by placing them on observation and soft diet. Active treatment of displaced and unfavorable mandibular fractures was by manual reduction and fixation under local or general anesthesia depending on patients' choice or preference. Fixation and immobilization was by inter-maxillary fixation (IMF) using maxillary and mandibular arch bars with 0.5mm stainless steel wires (closed reduction), and the period of immobilization lasted for two weeks for condylar fractures, and five weeks for fractures at other mandibular sites. Following treatment, the same post-operative instructions, antibiotics and analgesics were given to the subjects.

A minimum of six visits was scheduled for each subject with an interval of one week in the first two weeks; the third visit was on the fifth week for the removal of the IMF. Subsequent appointments post-IMF was scheduled after one, three, six months and yearly.

The treatment outcome was assessed from complaints during the follow-up, including clinical and radiological examination (where needed) of the subjects as they presented. Two weeks of domestic jaw exercises were recommended for all subjects after the release of IMF.
Successful treatment was defined as stable bone, return to pre-trauma aesthetics, absence of limitation of mouth opening, absence of pain and infection at the fracture site during function. Complications were conditions in subjects that occurred during and after treatment and persisted beyond nine weeks from the commencement of treatment.

The data obtained were recorded in a pro-forma and included age, sex, occupation, incidence, mechanism of injury, site/type of fractures, concomitant injuries, and the month/year the patients presented. Other factors documented were methods of treatment and complication. The data were analyzed with EPI Info 2008 version software (CDC, Atlanta, GA, USA). Analysis included simple frequency charts, descriptive statistics and test of significance. P values <0.05 are considered significant.

RESULTS

A total of 978 patients with 1381 mandibular fractures were seen during the study period; those patients who had mandibular fractures due to sports activity were 76/978 (7.8%). However, those who met the inclusion criteria were 72/978 (7.4%) patients who had 79/1381 (5.7%) fractures at different mandibular sites; while on the contrary, 4/76 (5.3%) patients were excluded. The patients excluded did not significantly (P=0.65) affect the outcome of the study.

The age and gender distributions of the patients are shown in table 1. There were 66 males and 6 females, giving a male to female ratio of 11:1. The males outnumbered the females in all age groups. The age (P= 0.001) and gender (P=0.000) distribution were significant. The age of patients ranged from 16-31 years (mean 25.2±1.3 years). Majority of the patients (n=55, 76.4%) were between the ages of 20 to 27 years, and this was significant (P=0.001). All the patients presented to the hospital within 24 hours after sustaining the fractures. The monthly and yearly distributions of patients during the study period are shown in table 2 and figure 1. The peak overall incidence was in July, and 2012 was the year with the highest frequency of patients. The table further showed that the frequency of sports-related mandibular fractures increased with fewer patients in the first five years (n=31, 43.1%) than in the next five years (n=41, 56.9%) of the ten-year period, and this increase was significant (P=0.03, Table 2). The occupations of the patients were as

follows: students (n=62, 86.4%), traders (n=8, 10.6%) and professional athletes (n=2, 3.0%). The patients' oral hygiene status was graded as fair and good.

Football related injuries in patients (n=63, 87.5%, P=0.000, Table 3) were the most common and these were due to hitting the elbow on the patients' faces by their opponents while struggling to head an aerial ball (n=34, 47.2%) and head on collision (n=29, 40.3%) with their opponents while struggling to make contact with the ball. Other mechanisms of injury were fall resulting from collision between athletes (sprinters) while running (n=5, 6.9%), fall after jumping up while playing basketball (n=3, 4.2%), and hit on the face by hockey ball accounted for one (1.4%) fracture. The common sites of the fractures were body of the mandible (n=43, 54.4%, P=0.001), parasymphyseal 20 (25.3%), condyle 8 (10.1%), angle 5 (6.3%) and symphyseal 3 (3.8%). Majority (n=63/79, 79.7%) of the fractures occurred in the body and parasymphyseal regions of the mandible, and were seen in patients between 20-27 years (P=0.001, Table 4). All the fractures were compound and non-comminuted. Displaced fractures occurred in 62 (78.5%) patients while the undisplaced fracture cases were seen in 17 (21.5%) subjects. Favourable fractures occurred in 77/79 (97.5%) fracture sites (P=0.000). Also 7 (9.7%) patients had double fractures while the rest, 65 (90.3%) single fractures.

Concomitant injuries occurred due to football related sport in 23 (32.0%) subjects, and these were head injuries diagnosed as cerebral concussion (n=13, 18.1%) and acute subdural haematoma (ASDH), 2 (2.8%). Others were nasal (n=5, 6.9%) and Le fort 1 fractures (n=3, 4.2%). There were no concomitant injuries in 49 (68.0%) patients. The distribution of mandibular fracture sites according to the frequency of fractures, mechanisms of injury and concomitant injuries are shown in table 3, figures 2 and 3.

The methods of treatment utilized to manage the patients were conservative (n=10, 13.9%) and closed reduction (n=62, 86.1%). The treatment outcome was good and satisfactory using these methods. The patients who had mandibular, nasal and Le Fort fractures without head injury were told to commence sporting activity after the release of IMF at five weeks. Those with associated cerebral concussion and ASDH waited for 11.2 weeks to 6.3 months before commencement of sporting activity. The mean follow-up period after the treatment of fractures was 8.3 ±2.7 months (range 8 weeks to 4.2 years). Limitation of mouth opening was recorded as complication in 3 (4.2%) patients treated by IMF. These were satisfactorily managed by physiotherapy.

DISCUSSION

This study showed that there was increase in mandibular fractures as the years progressed during the ten-year study period, peaking during the month of July and year, 2012 and the mechanisms of most of the fractures sustained were by football-related sport. The result confirmed the assertion that the mechanisms of sports- related injuries to the mandible depends on the most popular sports practiced within an environment. [9, 13] Football is the most popular sports in this environment and that accounted for the reason for it being the predominant cause of the fractures. It is played at both amateur and professional levels. That most of the fractures occurred in students who were amateur footballers suggests that they were inexperienced on how the game is played safely and this may have predisposed them to the injuries. Evidence have shown that amateur athletes do not use protective clothing or equipment during sporting activity, coupled with inexperience, they are the majority of patients reported to sustain these fractures in some other studies. [8, 10] It has also been

reported that fractures can occur from contact between athletes, athletes and the object that is played and between athletes and their surroundings including equipment. [14, 16, 17]In the present study, contact between athletes was the most common cause of mandibular fractures. The mechanisms of the injuries leading to fractures reported in this study have also been documented by earlier authors. [8, 14, 15] The incidence of the patients (7.4%) affected by the fractures was similar to earlier reports [9, 17] but contrary to those of Sojat et al., [16] and Antoun and Lee, [18] who recorded 12.2% and 21.7% respectively in studies that were of shorter duration with some of their athletes wearing protective gears during sports. Similar to this study, Emshoff et al., [13] showed that the five yearly distribution of sports-related mandibular fractures increased from 28.6% in 1984 to 1988 to 34.5% in 1989 to 1993, but this was different from the gradual decrease over 16-year period recorded by Delilbasi et al. [14] In the present study higher frequency of the fractures occurred in the months of July and August which is the peak period of the rainy season in this part of the world; the playgrounds are wet and slippery creating stability problem for the athletes, and the consequent hazardous fall which sometimes led to forceful contact between athletes in motion. This is also supported by the finding from this study which showed that most of the lower frequencies of the affected subjects occurred during the peak period of dry season (i.e. January, February, and December).

The age and gender distribution of the patients was closely similar to those of previous researchers, [8, 19, 20] but was contrary to the report of Benedetti and Tanushevski, [17] who showed a lower age range and 3:1 male to female ratio. As this study shows and as documented by earlier researchers, mandibular fractures that occur during sports affect mainly the young age. [8, 21, 22] The highest frequency of patients was recorded between 20 and 27 years in the present study whereas in the studies by Delilbasi et al., [14] and Mourouzis and Koumoura[8] it was 10-19 and 21-30 years respectively. It should be noted that the variability in the incidence of the fractures is due to factors such as the study design including duration, size of the population under consideration including their socio-economic status, age, gender, race, and geographical location, as well as the mechanisms of the injuries. [3, 7, 16]

All the mandibular sites commonly prone to fracture were affected in the present study. [21] However, the most common site was the body of the mandible. In the study by Maeda et al., [22] body of the mandible was the most common fracture site whereas other researchers, [8, 13, 17] documented the mandibular angle or sub-condylar region. As this study shows these fractures are mostly compound and favorable, but rarely comminuted and multiple which is in agreement with most other reports. [19, 20, 23]

This study also showed that concomitant injuries (32.0%) can occur in association with mandibular fractures related to sports. Similar findings were noted by other researchers. [2, 24, 25] Furthermore some earlier researchers have observed that a relationship exists between specific sports and the type and site of associated maxillofacial bone fractures. [13, 17, 19]This is possible because it has been observed that the athletes' face and head are not protected when some sports particularly those identified in this study are played. However, if the duration of the previous studies is taken into account the frequency of the concomitant middle third of the face fractures in this study was lower than in most other reports. [9, 14, 16, 18] Also, in agreement with other studies, more cerebral concussion was recorded than other head injuries. [24, 25] ASDH is rarely associated with playing football. [2, 4]

The methods of treatment used to manage the fractures have been reported to be effective with good treatment outcome. [10, 11, 26, 27] However, active intervention was higher (86.1%) in the present study compared with most other reports. [8, 14, 18, 23] Limitation of mouth opening was the only complication recorded after treatment. Similar report was documented by earlier researchers. [5, 11]The limitation of mouth opening occurred in patients treated by IMF which sometimes occur as a consequence of this treatment technique, or may have been due to other reasons that were not revealed by the plain radiographs used to manage the patients. Also, the patients with only facial fractures were advised to return to sporting activities after five weeks while Tanaka et al., [23] restricted their patients for 8 to 12 weeks after the initial treatment of mandibular fractures. In the presence of concomitant head injuries, the period of this restriction is usually extended. [2, 25] Viozzi, [9] and Zandi and Hoseini, [28] emphasized that the decision to return to sporting activities should be individualized, taking into account the patients' age, pattern of injury, time since injury occurred, treatment being administered, compliance to treatment regimen and the likelihood of another facial injury. However, the successful outcome of treatment in this study is attributable to the early clinical assessment and management of the fractures, young age of the patients, undisplaced and the favourable nature of the fractures, uncomminuted and low multiplicity of the fractures, acceptable oral hygiene status, and patients' diligence in carrying out post-operative instructions. Furthermore, some earlier researchers have noted that sports-related facial fractures are less severe with better treatment outcome than those due to other causes. [18, 20]

This study showed that 5.3% patients that had mandibular fractures due to sports did not meet the inclusion criteria. However, this did not significantly (P= 0.65) affect the outcome of the study. Also, the study was limited by the use of only plain radiographic views for the imaging technique, and closed reduction method for the treatment of the fractures because computerized tomography scan and rigid internal fixation were not available during the period of the study. These would have also improved the treatment outcome.

CONCLUSION

Although the treatment outcome was good, this study has shown an increasing trend in the occurrence of sports-related mandibular fractures, with team sports being responsible for majority of the cases. Most of the fractures were football related. With the increasing popularity of sports and involvement of amateur athletes, there is a need to institute coaching instructions especially in schools and colleges in order to target the age group at risk; and to reduce footballing activities during the peak of rainy season.

Table 1: Distribution of age and gender of patients with mandibular fractures.

	Male		Female		Total	
Age group (Years)	n	%	n	%	n	%
16-19	12	16.7	1	1.4	13	18.1
20-23	21	29.3	3	4.2	24	33.4
24-27	29	40.3	2	2.7	31	43.0
28-31	4	5.5	0	0.0	4	5.5
Total	**66**	**91.7**	**6**	**8.3**	**72**	**100.0**

Age: χ^2= 194.386, df =12, p=0.001

Gender: χ^2=226.481, df=12, p=0.000

Table 2: Monthly and yearly distribution of patients with mandibular fractures.

Months	**Years**										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
January	0	0	1	1	0	0	0	1	1	0	4
February	1	0	0	1	0	0	2	0	0	0	4
March	0	0	1	1	0	1	1	0	1	0	5
April	0	1	0	0	2	0	1	2	0	1	7
May	1	0	0	0	1	0	2	0	1	1	6
June	0	0	0	0	0	1	0	1	0	0	2
July	2	3	0	2	1	1	0	1	2	1	13
August	0	2	0	1	1	0	1	1	2	1	9
September	1	0	0	0	0	3	1	1	1	0	7
October	0	0	1	1	1	0	1	0	0	0	4
November	0	1	0	1	0	2	0	1	1	1	7
December	0	0	0	1	1	0	1	1	0	0	4
Total	5	7	3	9	7	8	10	9	9	5	72

χ^2= 148.213, df =8, p=0.03

Table 3: Distribution of mandibular fracture sites according to the frequency of fractures, mechanisms of injury and concomitant injuries.

Site	Elbow	Mechanisms of injury: Head collision	Fall (Sp)	Fall (Bb)	Frequency: Hockey ball	(Total)	%
Mandibular							
Body	24	15	1	2	1	43	54.4
Parasymphysis	10	6	3	1	0	20	25.3
Condyle	3	3	2	0	0	8	10.1
Angle	3	1	0	1	0	5	6.3
Symphysis	0	1	2	0	0	3	3.8
Total						**79**	**100.1**
Concomitant							
Concussion	**1**	10	1	1	0	13	56.5
Nasal	**1**	2	1	1	0	5	21.7
Le Fort 1	**1**	0	2	0	0	3	13.1
ASDH	**0**	2	0	0	0	2	8.7
Total							**100.0**

χ^2: 206.481, df=12, p=0.000

NB: Sp= Sprinter; Bb= Basketball.

Table 4: Distribution of the types and frequency of mandibular fracture according to age of the patients

	Types and number of fractures						
Age group	Body	Parasymphysis	Condyle	Angle	Symphysis	**(Total)**	**%**
16-19	9	5	2	1	0	17	21.5
20-23	13	7	3	2	1	27	34.2
24-27	18	8	2	2	2	32	40.5
28-31	2	0	1	0	0	3	3.8
Total	43	20	8	5	3	79	100.0

χ^2= 198.572, df =12, p=0.001

Figure 1: Yearly distribution of mandibular fractures.

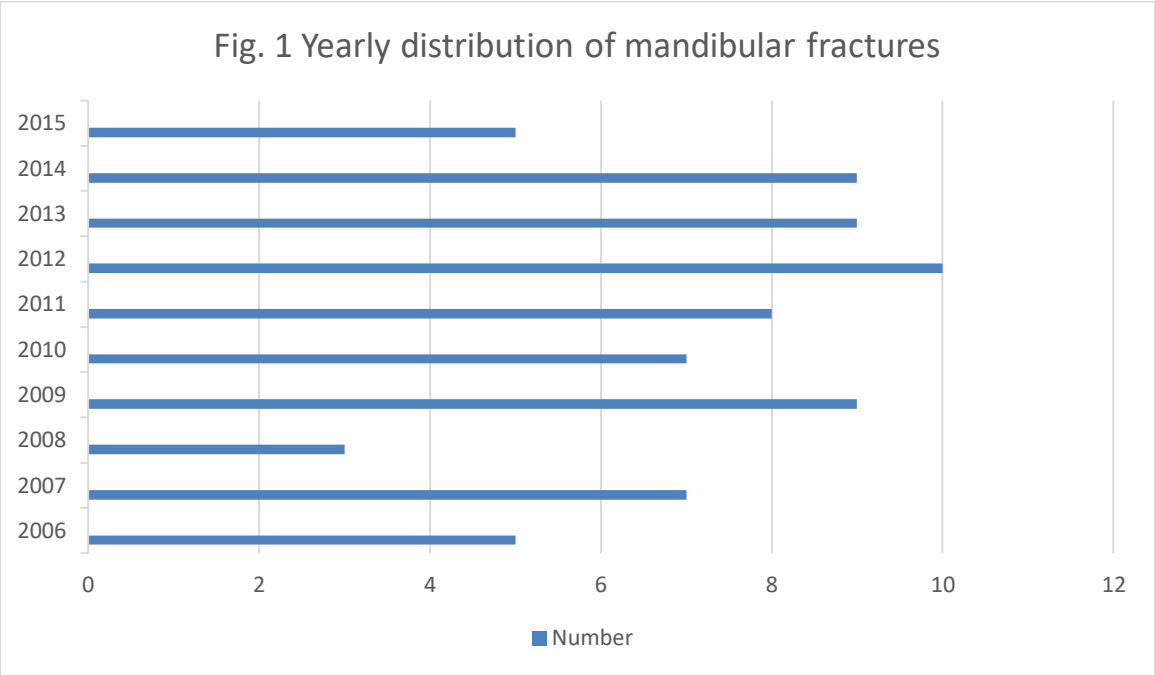


Figure 2: Mechanism of injury.

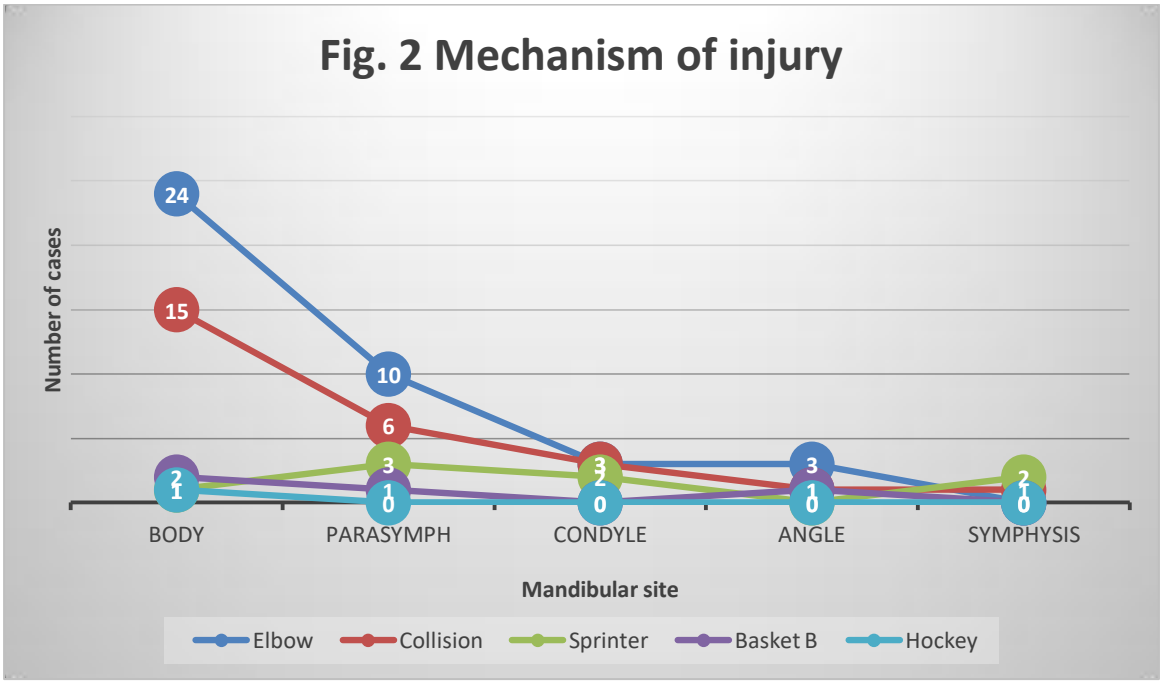
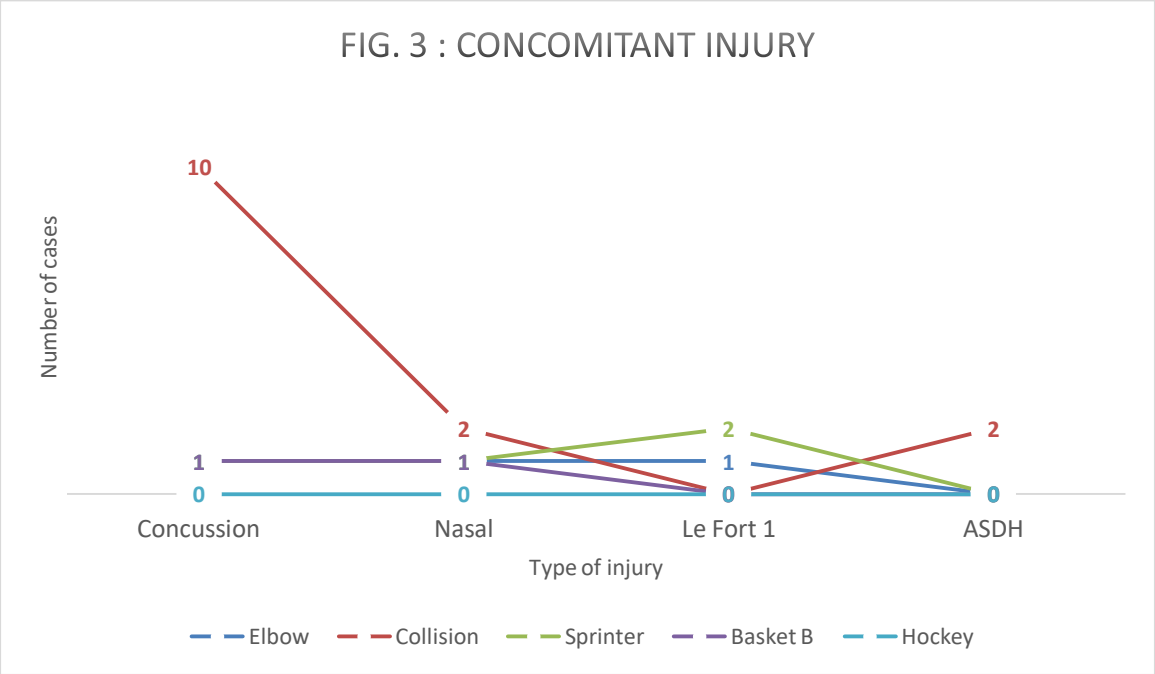


Figure 3: Concomitant injury.



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