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PREVALENCE OF TRAUMATIC INJURIES CAUSING NON VITALITY OF TOOTH LEADING TO ROOT CANAL TREATMENT - A RETROSPECTIVE ANALYSIS

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Abstract

Traumatic dental injuries are impact injuries that occur due to external factors. It is frequent and unavoidable. These injuries are more common in younger age groups, particularly in children and adolescence. Males are more prone to these dental injuries than females. Anterior teeth are the most affected. Few of the complications of these injuries include: pulp necrosis, infection, internal resorption, apical periodontitis, disturbances in root development, etc. Pulp vitality tests are done to examine the presence of blood flow. Treatments for traumatic dental injuries depend on the severity of the injury. Re-implantation of the tooth, restoration of the fractured tooth, root canal treatment, crowns, extractions, etc. The aim of this study is to assess the association between traumatic dental injuries that lead to root canal treatments and gender. A retrospective study was done in an institutional setting. A sample size 872 was taken into consideration. All patients who underwent root canal treatment in the time frame of June 2019 – April 2020. Only anterior teeth that underwent trauma and required RCT were taken into account. The patients detailed case sheets were evaluated. Collected data was imported into SPSS software for data analysis. The total number of patients involved in the study was 289, out of which 76.4% (220 patients) were males and 23.6% were females. Ellis Type II and Type III fractures were taken into account. 13.9% (40 patients) were diagnosed with Ellis type II fracture and 86.1% (248 patients) were diagnosed with Type III fractures. Majority of the patients (96.5% - 278 patients) had undergone RCT as their treatment and the remaining 3.5% had LCR restorations done. A cross analysis between age and Ellis fracture was done. Majority of the patients were prone to getting a dental injury in the age group of 21-40, for both Type II and Type III fractures. (p value< 0.05= significant) The cross analysis between gender and Ellis fracture showed that male patients were higher in number for both type II (23 patients) and Type III (197 patients). (p value < 0.05= significant). Young males are more prone to traumatic dental injuries as compared to females. There were higher chances of the injury leading to a Root Canal Treatment in both Type II and III Ellis fractures.

Keywords: *Fracture, Injury, Root canal, Trauma, Vitality*

I. Introduction

The importance of an anterior tooth is realized only when the smile is compromised due to its damage. The greatest feature of an individual is considered as the smile, the lack of which has been found to affect both self-esteem and social relationships[1]. Dental trauma is an irreversible pathology that after its occurrence is

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characterized by lifelong debilitating effects. Anterior dental trauma is a common injury pattern of the dentoalveolar system[2].

A dental traumatic injury can occur at practically any stage of life. The more prone age group would be children and adolescence due to their higher range of activity[1,2]. Traumatic injuries do not just pose a health risk, but is also a great social problem. It can affect behavior and day – to day activities. Generally, the issue is localized to a single tooth, but in severe trauma, may involve multiple teeth.

The leading causes of anterior dental injuries are in children. At a toddler stage, due to lack of balance, falls are quite common and could lead to fractures, a higher incidence rate is for children of school going age, due to sporting activities. Other causes would include road traffic accidents, physical fights, sports injuries, trauma, etc[3]. Male individuals are more prone to dental injuries as compared to females. There are many studies that prove the fact that men are more prone, due to higher rates of activity compared to females.

There are various types of dental injuries. Its immediate evaluation, proper treatment and management of the dentition can result in saving and restoring the tooth structure[4]. Uncomplicated crown fractures are common in the permanent dentition. It is one of the most common types of dental injuries. Subluxation injuries are mostly seen to affect primary dentition and are also quite high in incidence. Displacement and avulsion are quite rare in incidence. These injuries can all be categorized into: injuries to the hard tissues and pulp, injuries to the hard tissues, pulp and alveolar bone process, injuries to the periodontal tissues. Each injury has its own prognosis and treatment. All are best if treated at the earliest. Majority of the dental trauma, in both primary and permanent dentition involves the anterior teeth, and the most affected are the maxillary central and lateral incisors[5]. A complication during treatment of traumatised teeth could be calcific metamorphosis which would make it difficult to access the root canals in order to treat the tooth[6].

A multidisciplinary approach is always best when treating any dental issues. The treatment should only be decided after a thorough clinical examination, and history of trauma. Mobility, pain on percussion, non vitality, etc decrease the long term prognosis of the tooth. The goal of treatment is to return the teeth to optimum function and esthetics[7]. Treatment concepts include: acute treatment (that is treated immediately- avulsions, fractures, extrusions, etc), subacute treatment (treatment within 24 hours) and delayed treatment (crown fractures without pulpal exposure). The treatment for an uncomplicated tooth fracture would be a restoration in most cases. complicated tooth fractures would likely involve the pulp and as a result an RCT must be done, crown-root fractures would have treatment options depending on the level of the fracture. RCT is an option as well. In case of avulsed teeth, it is always best to store the tooth in mediums such as milk, propolis, coconut water, green tea extract, egg white, green tea extract, Aloe Vera gel, pomegranate juice, salvia, while planning the course of treatment. [8,9] Esthetics and function should be kept in mind during treating any dental problem. Materials such as RMGIC are considered more superior in terms of marginal adaptation and esthetics [10,11]. With new techniques such as the occlusal stamp method for composite restorations, it has been easier and more esthetic to restore the tooth. [12]. Tooth coloured restorations have also played a major role in providing optimal esthetics for the patient's anterior tooth [13]. The use of amalgam as a restorative material has declined over the ages as they have many drawbacks[12],[14][15]. The minute fractures can be treated with veneers and crowns[16]. Hypersensitivity will be a very common complaint that is reported during followup visits. They can be prescribed desensitizing chemical agents to reduce the sensitivity.

All traumatized teeth must be monitored regularly for pulpal necrosis. Remineralising pastes can be prescribed in order to make sure that no secondary caries occur post treatment[10]. The vitality of the tooth must be checked. This can further help with treatment planning. Various methods of testing would include: test cavity,

percussion, heat test, cold test, anesthetic test, occlusal pressure test, electric pulp test, etc[17]. Thorough knowledge regarding the various aspects of a treatment is required to provide patients with the best possible service[18].

The aim of this study was to deduce the gender predilection of traumatic injuries and the incidence of root canal treatment due to the same.

II. MATERIALS AND METHODS

A retrospective study was conducted in an institutional setting. The ethical clearance was received from the institution's ethical committee (ethical approval number- SDC/ SIHEC/ 2020/ DIASDATA/ 0619-0320). The study involved all the patients who had undergone Root Canal Treatment due to dental trauma.

Selection of subjects

872 patients who had undergone RCT due to dental trauma were considered for this study. The time period of choice was from June 2019 to April 2020. There were three reviewers involved in this study. All available data was collected and sorted.

Data collection

The detailed case sheets of the patients were analysed using parameters such as age, gender, Ellis fracture and Treatment were considered for this study. Cross verification of the data was done by the second reviewer, to avoid any missing or repetitive data. The data was manually retrieved and tabulated in Excel, and sorted.

Inclusion criteria

All patients with dental trauma in their anterior teeth, who had undergone RCT were considered for this study. All age groups were considered.

Exclusion criteria

Patients with incomplete records were removed from the study. Repetitive entries were also excluded.

Statistical analysis

The tabulated data was analysed using SPS software (IBM SPSS statistics 26.0). The method of analysis that was used was “Chi square test”. The analysis was done between:

- Age and Ellis fracture
- Ellis fracture and treatment
- Gender and Ellis fracture

III. RESULTS

The present study was done to deduce the gender predilection of traumatic injuries and the incidence of root canal treatment due to the same.

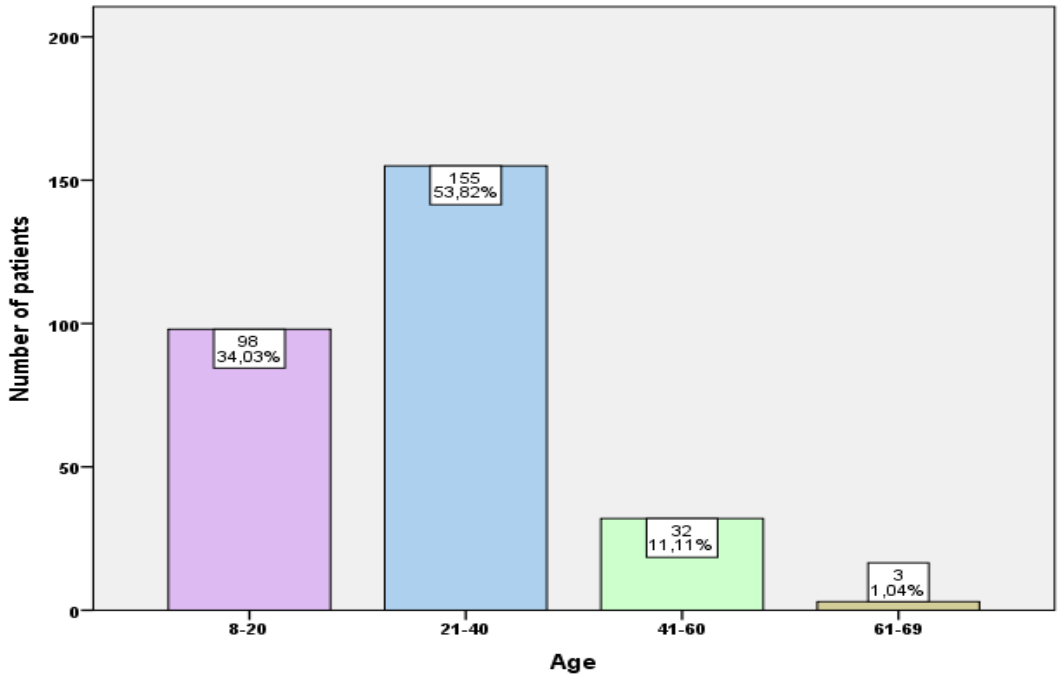

Figure 1: Bar chart shows the age distribution in the study. X-axis represents the different age groups; Y-axis represents the number of patients. Violet colour represents the number of patients within the age groups of 8- 20 yrs (34.03%), light blue represents the number of patients within the age groups of 21-40 yrs (53.82%), light green colour represents the number of patients in the age group of 41-60 yrs (11.11%), beige colour represents the number of patients in the age groups of 61- 69yrs (1.04%). From the graph, it can be inferred that the majority of the patients were within the age group of 21-40 years.

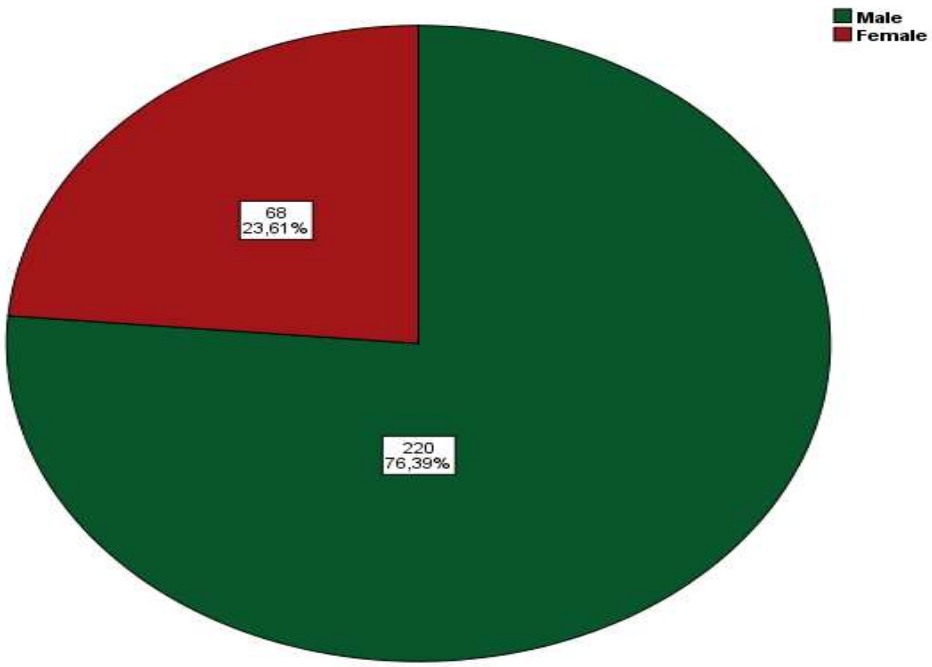

Figure 2: This pie chart shows the gender distribution in the study. Dark green colour denotes the number of males in the study (76.39%) which is the majority. Red colour denotes the number of females in the study (23.61%)

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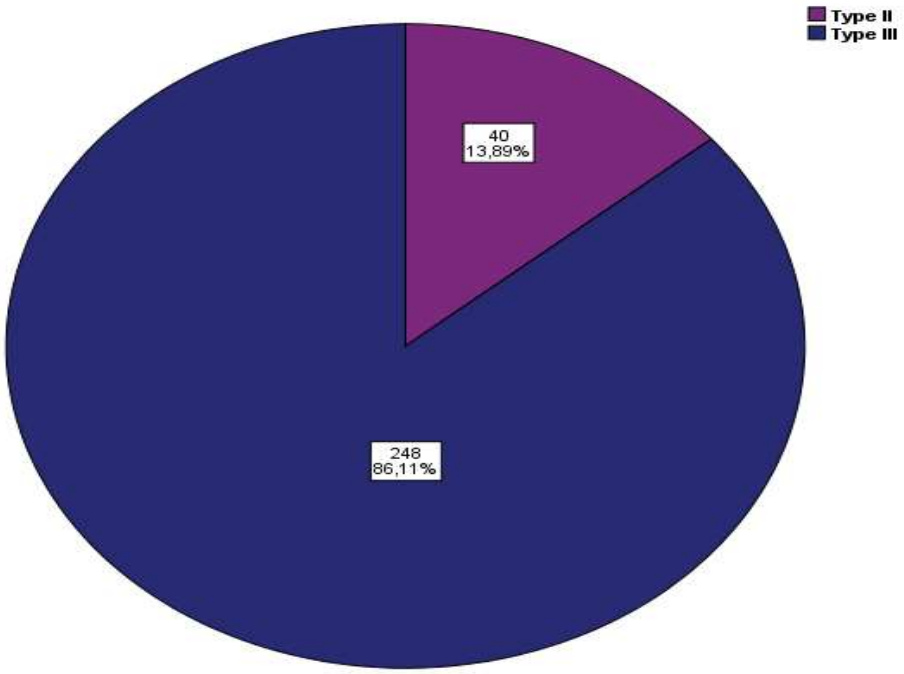

Figure 3: This pie chart shows Ellis fracture (Type II and III) distribution in the study. Purple colour denotes Type II Ellis fracture (13.89%) and dark blue colour denotes Type III Ellis fracture (86.11%).

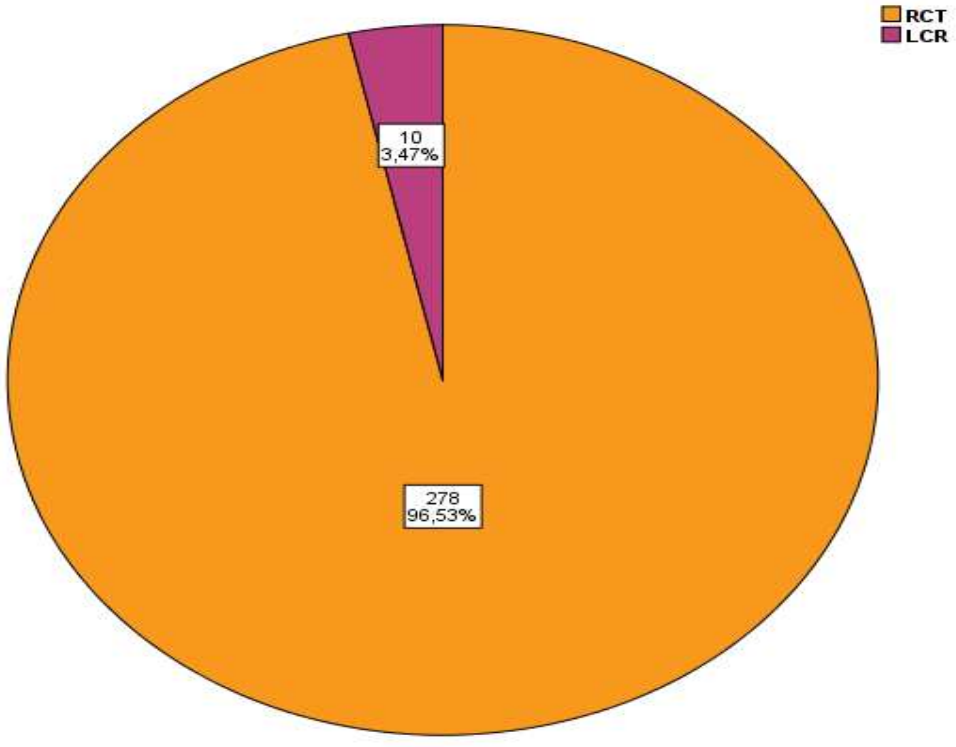

Figure 4: This pie chart shows treatment distribution in the study. Orange colour represents the number of patients who underwent RCT (96.53%) and dark pink colour represents the number of patients who underwent LCR restorations (3.47%)

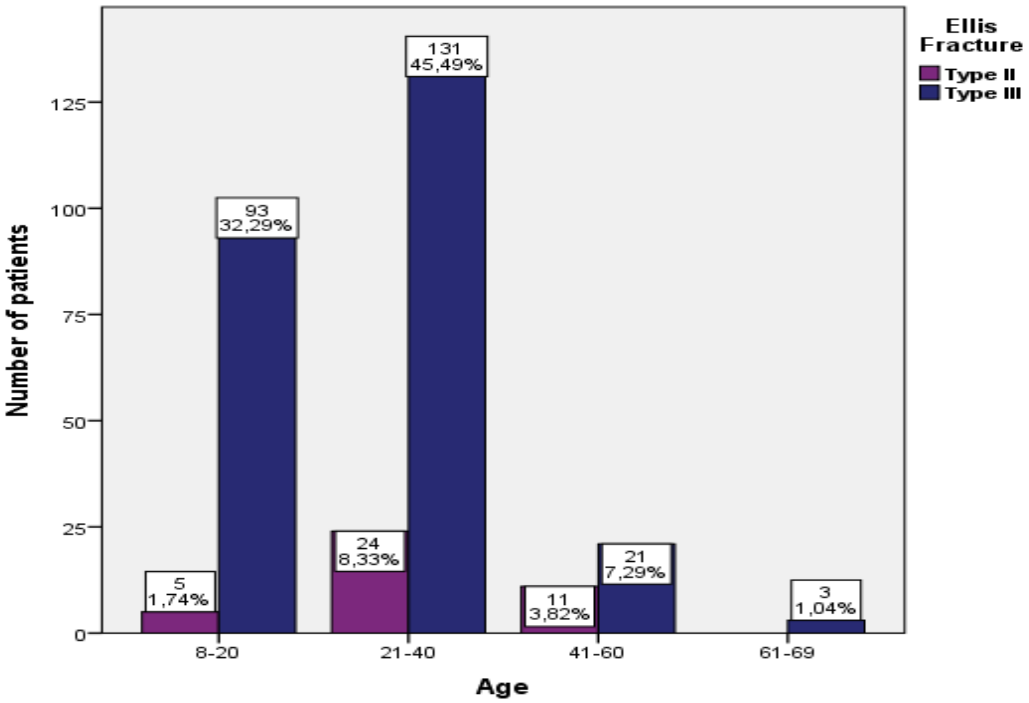

Figure 5: Bar chart represents the association between Age and Ellis fracture. X-axis represents the patient's age and Y-axis represents the number of patients in each category. The number of cases with Type III Ellis fractures (Dark Blue) were greater than Type II Ellis fracture (purple). From this we infer that patients belonging to the age group of 21-40 were having type III Ellis fracture than any other group. (Chi square test; p value- 0.00 (<0.05) which means it is highly significant.

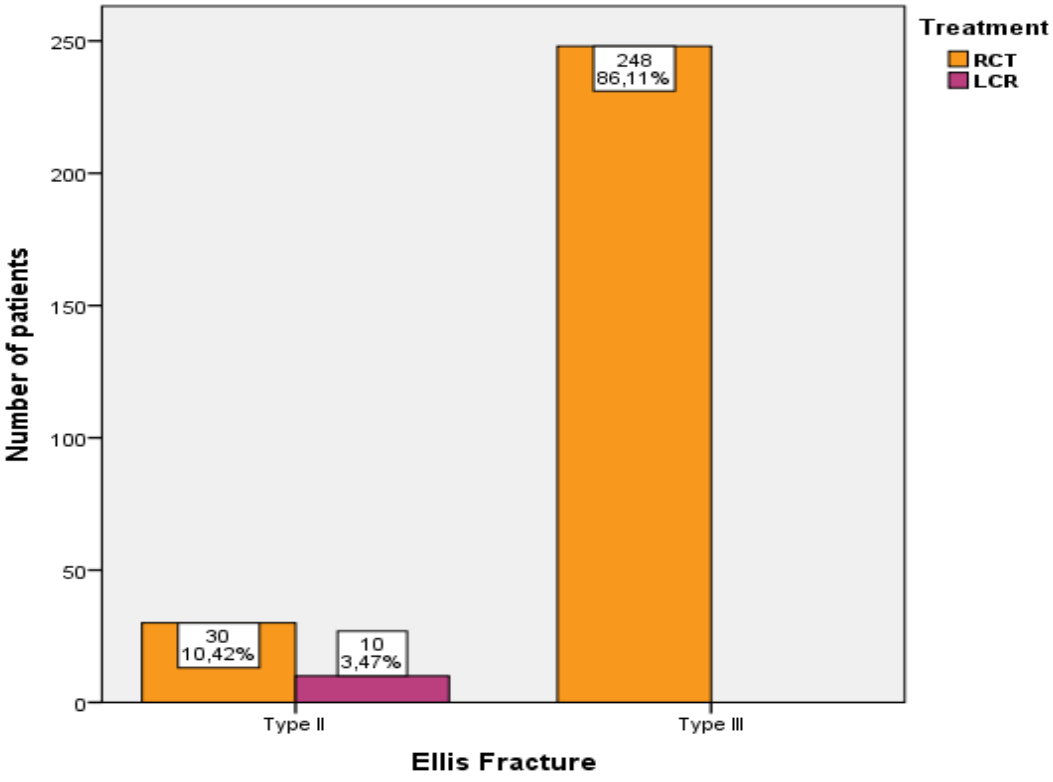

Figure 6: Bar chart represents the association between Ellis fracture and treatment. X-axis represents the 2

fractures (Type II and Type III). Y-axis represents the number of patients in each category. The number of patients who had to undergo RCT (Orange) was greater than the number of patients who required an LCR restoration (Dark pink). From this we infer that patients who were diagnosed with Type III Ellis fractures were more prone to getting an RCT than patients with Type II Ellis fractures.(Chi square test; p value- 0.00 (<0.05) which means it is highly significant.

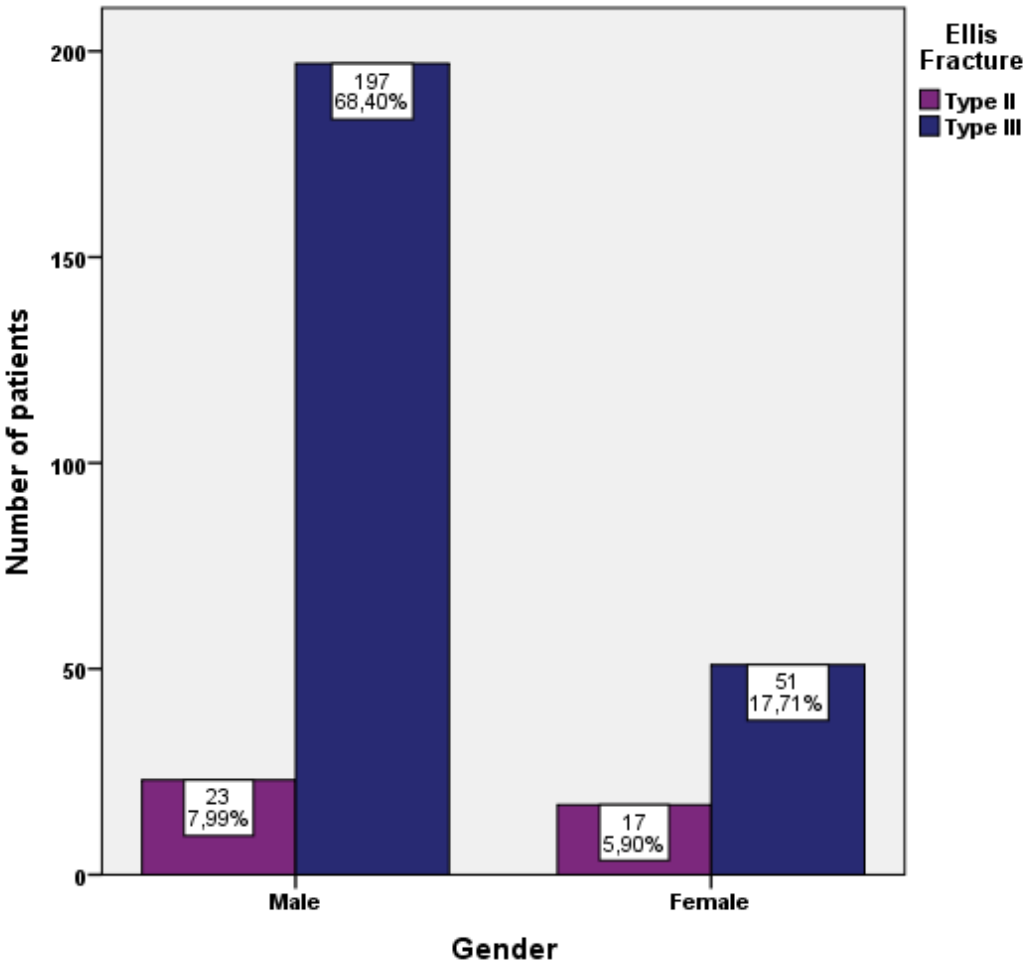

Figure 7: Bar chart represents the association between gender and the type of Ellis fracture. X-axis represents the gender; Y-axis represents the number of patients. The number of cases with Type III Ellis fracture (Dark blue) was greater than the cases diagnosed with Type II Ellis fracture (purple), in both male and female groups. From this we infer that patients who were male and diagnosed with Type III Ellis fracture were more as compared to females. (Chi square test; p value- 0.02 (<0.05) which means it is highly significant.

Age, Gender Ellis fracture and Treatment distribution in the study:

The total number of patients that were included in the study was 287. The patients were categorized into groups depending on their age and the 4 age groups were: 8-20 years, 21-40 years, 41-60 years, 61-69 years. The highest numbers of patients were in between the age of 21-40 years (155 patients). The age group least likely to experience dental trauma was seen to be within 61-69 years (3 patients). The graphical representations of these results are seen in Figure 1.

More number of male patients were seen to have fractures on their anterior teeth than females. 76.4% of the patients were male patients and the remaining 23.6% were females. These frequencies are illustracted in Figure 2.

Type II and Type III Ellis fractures were taken into consideration for this study. 86.1% of the cases that were recorded had Type III Ellis fracture and the remaining 13.9% were diagnosed with Type II Ellis fracture. These results are seen in Figure 3

The number of patients who underwent RCT for their fractured tooth was about 278 (96.5%) and the remaining 3.5% involved patients who had multiple fractures and restorations were also done on them. This is seen in Figure 4

Analysis between Age and Ellis fracture:

The cross analysis between age and Ellis fracture showed that 21-40 years of age were more prone to dental fractures. 24 patients were diagnosed with Type II and 131 patients with Type III fractures. Age 61-69 were least prone and they only had 3 patients who were diagnosed with Type III Ellis fracture. The data is illustrated in Figure 5 (p value< 0.05= significant)

Analysis between Ellis fracture and Treatment:

Table 6 and 7 show the data from the cross analysis between Ellis fracture and treatment. All the patients diagnosed with Type III Ellis fracture and underwent RCT (248 patients). The patients diagnosed with Type II fracture, 10 patients had also undergone LCR restoration, and 30 patients had undergone RCT. (p values < 0.05). The data is illustrated in Figure 6.

Analysis between Gender and Ellis fracture:

The cross analysis between gender and Ellis fracture showed that male patients were more in number when compared to females to have a fracture on their anterior teeth. In both males and females, Type II fractures were more common (males= 197, females= 51). (p value<0.05) The data is graphically represented in Figure 7.

IV. DISCUSSION

Teeth are an important part of an individual's life. When an anterior tooth is damaged due to trauma, it is best to assess and treat it as soon as possible so the patients day- to- day activities are not compromised[19].

The present study investigates various trends in fractured teeth. The study focused on maxillary anterior teeth as they were the most commonly affected. The parameters assessed in the study included: Age, Gender, Ellis fracture and Treatment. Another area of focus was on cases that had undergone RCT due to non-vitality or pulpal exposure.

It is a known fact that younger age groups are more active as compared to older age groups. The present study states that 21-40 years and 8-20 years of age had a higher rate of incidence of traumatic dental injuries as compared to age groups of 41-60 years and 61-69 years. This finding corroborates with previous research conducted by Mithra Nidharsh et al (2015)[20]. Her study stated that there was an increased prevalence of cases of anterior tooth fracture in the age group of 15-30 years. Another study by M C Patel et al (2012)[21] stated that anterior tooth fractures were more common in younger age groups such as school going children.

In the present study, it is seen that males are more prone to being diagnosed with a traumatic injury than females. 76.4% of the patients in the study were males. It is a known fact that after infancy and before old age, males engage themselves in more risk taking events that may lead to injuries later[22]. A study by Shabin S et al (2015)[20,23] stated that males are more prone to having fractured anterior teeth compared to females. Her study showed 56.8% of the individuals that participated in the study to be males. Males have a higher chance of getting exposed to occupational accidents, road traffic accidents, sports injuries, violence, etc that could lead to

tooth fracture. Dental traumas such as vertical root fractures were more common in females than in males in some studies [24,25].

The severity of the dental fracture would depend on the severity of the impact. The exposure of the pulp would be a complicated fracture and would lead to a lengthier treatment time. In the present study, the majority of the patients were diagnosed with Type III Ellis fracture. 86.1% of the patients who were undergoing RCT were diagnosed with Type III Ellis fracture. A study by Nikita Goyal et al[26] stated that the prevalence of Type III Ellis fractures were comparatively lesser than that of Type II Ellis fractures. Only 13.2% of the cases in the study were diagnosed with Type III Ellis fracture. The overall outcome of the study had stated that Type I Ellis fracture was the most common. Another study that also opposes the present study was that done by Andersson et al (2010)[27]. In this study, Ellis Type II fractures were more common compared to Type I and III.

The ideal treatment choice for a complicated tooth fracture is a Root Canal Treatment, in the present, majority of the patients had undergone RCTs and out of that there were 10 patients who also had LCR treatments done for other teeth. Post operative pain can be considered a complication in any dental treatment. As a result, in many cases,, in order to reduce post operative pain, endo activators are advised to be used while irrigating in order to provide the patient with a comfortable treatment[28]. For better results during treatment it is advised to use a standard rotary file such as ProTaper Universal and ProTaper Next as it causes higher thinning of root dentin of the root [29] with proper irrigation that is vital for any root canal treatment for efficient dissolution of organic and inorganic tissues [8],[30]. Pain can be controlled during treatment by administering Local anesthesia, and post treatment with analgesics[31].

As we can see in Figure 5, dental trauma is more common in the younger age groups. Out of the fractures, Type III Ellis fractures are more common for undergoing RCT. These fractures would involve the pulp and would require RCT in order to prevent further damage. Many cases have been reported regarding complicated tooth fractures and its treatments with younger age groups. A case report by Francisco Ojeda et al (2013)[32], reported that a multidisciplinary approach to treating a child who was diagnosed with a complicated tooth fracture.

In case of Type II Ellis fracture, cross checking the tooth's diagnosis both radiographically and also with a vitality test is of importance. Type II fractures, if normal, can be treated with restorative treatments. When the tooth is tested as non-vital, the treatment option would be to do an RCT. Akash Krishna et al (2012)[32,33] has reported many cases with complicated crown fracture in adolescents. He had enforced the rule of conserving the remaining tooth structures. Case reports of reattachment procedures were discussed. Treatments such as fiber post followed by permanent restoration [34], ceramic/ porcera all ceramic crowns [35], etc are all treatment options as an adjunct to Root Canal Treatment.

As said before, males are more prone to dental fractures as compared to females. Figure 7 shows the difference between male and female patients when comparing their diagnosis. Males have more prevalence for both Type II and Type III Ellis fractures. Elisa B et al (2000)[36], stated that males experience significantly more trauma to their permanent dentition than females. Two Australian studies Martin et al[24], also stated the same. The male: female ratio for the prevalence of dental trauma was seen to be 2.6:1. This, as discussed before, could be due to more numbers of males participating in sports activities and violent behavior.

Study Limitations

This study cannot be generalized to a wider population due to its small sample size. It focuses on one locality. It cannot truly compare the incidence rate of different types of Ellis fractures or its treatment as we only focused on patients undergoing RCT

Future Scope

Can approach the etiology of the traumatic injury. We can increase the area of study and involve people of different ethnicities. More than one treatment can be focused on

V. CONCLUSION

Within the limits of the study, we can state that traumatic dental fractures occur more in younger patients. Male individuals are more prone to the damage due to their nature. Type III Ellis fractures were more commonly diagnosed and RCT was the ideal choice for treatment.

AUTHOR CONTRIBUTIONS

Reshma HK contributed in the concept design of the study, sequence alignment, statistical analysis and drafted the manuscript. Dr.Manish Ranjan participated in the design of the study, statistical framework, manuscript drafting. Dr.Balaji Ganesh S contributed in coordination of the study, manuscript drafting and proofreading. All authors read and approved the final manuscript.

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