International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Endodontic Orthodontic Treatment of Traumatized Teeth using Intracanal Medication

Dr. Reham Adel Hijazeen[1], Dr. Iasmina Ziad Alhiasat[2], Dr. Duaa Tawfiq Altawalbeh[3], Dr. Ahmad Mustafa Altarawneh[4], Dr. Feras Abass Al Qatarneh[5]

Dental Department, Royal Medical Services, Amman, Jordan

Abstract: ***Dental trauma happens frequently in children and adolescents between 8and 18years of age, involving mostly the upper central incisors. Sometimes, an orthodontic patient will accidentally traumatize his/her teeth before or during orthodontic treatment. When the trauma is substantial, it can avulse the tooth. Reimplantation and adequate emergency treatment to preserve the injured tooth in the oral cavity is indicated. Therefore, to minimize the complications that may occur, such as root resorption or ankylosis, intracanal medication is advised to eliminate bacteria that contribute to the inflammatory process and consequently induce resorption. These study describes the endodontic-orthodontic considerations for patients with traumatized anterior teeth using intracanal medication or not at Prince Ali bin Alhussain Hospital in the south of Jordan. Patients who experienced tooth trauma and had endodontic-orthodontic treatment were studied retrospectively utilizing a clinical evaluation. The study found that male and female patients were different with regard to the type of trauma; accordingly, intrusion, extrusion, subluxation, and crown-root fractures were most common in male patients with 72.7%, and crown-root fracture, avulsion, and lateral luxation were most common in female patients with 63.4%. It was also found that 24.3% of female patients and 22.9% of male patients were infected. Additionally, 52.6% of the participants were recorded as not being sure of having intracanal medication in the traumatized tooth. Further studies are recommended to identify any affecting factors.***

Keywords: Endodontic orthodontic treatment, dental trauma, intracanal medication

1. Introduction

Traumatic dental injuries (TDIs) are frequently linked with complicated injury patterns, making an accurate diagnosis critical to formulating an appropriate therapeutic strategy. Most injuries can be broken down into smaller parts and linked to the tissues that are injured, such as dental hard tissues, dental pulp, periodontium, alveolar bone, or gingiva [1, 2, 3]. A traumatic dental injury should be addressed as an emergency as soon as possible. Extra- and intraoral examinations, palpation, pulp testing, study of tooth movement or displacement, and radiographic assessment are all part of the diagnostic process. Furthermore, instructive images are required not only for the first diagnosis, but also for forensic purposes in order to verify that specific issues are the result of the traumatic experience[4]. Crown fractures may disclose extensive dentine wounds or pulpal exposure after removal of a coronal fragment, if necessary[5, 6, 7].

Multiple restorative, endodontic, and periodontal aspects must be taken into account when treating TDIs. The International Association of Dental Traumatology's recently revised guidelines [8, 9, 10] provide clear recommendations for the immediate and urgent care of TDIs, but they lack detailed background information and do not report treatment outcome data. The goal of this comprehensive analysis is to give clinicians an in-depth understanding of endodontic management of traumatized permanent teeth and to empower them to choose the best endodontic technique by assessing the outcomes of these treatments.

Pulp necrosis with root development disruption is one of the most common consequences of traumatic dental injuries in children aged 7 to 14. Reinnervation and reestablishment of the vascular supply are predicted if an injury to an immature tooth happens without necrosis, allowing the tooth to continue to grow. If the pulp tissue becomes necrotic, the blood supply is disrupted, and root formation is halted, this results in a tooth with open apices and thin, vulnerable dentinal walls. Apexification with calcium hydroxide-based drugs. Implantation of an apical barrier with mineral trioxide aggregate (MTA) followed by root canal obturation with gutta-percha, and pulp revascularization are some of the treatments proposed for this problem[11, 12, 13].

Pulp revascularization has been shown to be a realistic and effective therapeutic option for young necrotic teeth. It provides advantages over traditional procedures, such as the ability to prolong root development and reinforce the dental structure as a result. Decontamination using root canal irrigants, insertion of intracanal medicine, induction of a blood clot, and coronal sealing are all steps in the procedure[14].

Because antibiotics are usually effective against endodontic pathogens, a triple antibiotic paste, described and composed of metronidazole, ciprofloxacin, and minocycline, has been considered the "gold-standard" intracanal medication for pulp revascularization procedures in recent years[9]. Antibiotics, on the other hand, come with dangers such as allergic reactions, bacterial resistance, removal difficulty, and the possibility of crown discoloration. The American Association of Endodontists (AAE) and the European Society of Endodontology (ESE) have recently issued guidelines recommending the use of calcium hydroxide-based medicines. According to a recent survey, 52.2% of endodontists in the United States choose calcium hydroxide intracanal medicines for pulp revascularization[15].

Calcium hydroxide is given extra antibacterial capabilities by using 2% chlorhexidine gel as an active carrier. This mixture works as a physical and chemical barrier, and has a pH of 12.8 roughly. Moreover, chlorhexidine has

antibacterial action, and is effective against a wide range of microorganisms, including Gram-positive and Gram-negative bacteria, yeasts, and fungi[16, 17]. The efficacy of this association has been demonstrated in pulp revascularization, with positive clinical and radiological outcomes.

Despite the fact that dental trauma is the most common cause of pulp necrosis in immature teeth, only three studies have focused on the clinical and radiographic outcomes of pulp revascularization in these teeth. As a result, the goal of this retrospective study was to look into the clinical effectiveness and quantitative radiographic alterations of root development in immature injured teeth treated with calcium hydroxide and 2% chlorhexidine gel as an intracanal medicine[18].

2. Materials and Methods

A retrospective study was performed using clinical examination on patients who had trauma to their teeth and went under endodontic-orthodontic treatment at Dental Department, Prince Ali bin Alhussain hospital, Al Karak, Jordan. The general health of the patient, the severity and type of trauma, the chronological and dental age of the patient, whether the patient had a device in the mouth during the trauma, using intracanal medication and some factors that determine the treatment will be the criteria of comparison between patients who had intracanal medication in their avulsed teeth and who did not.

Treatment protocol

Several endodontists[19] with more than two years of experience performed pulp revascularization procedures utilizing the standard protocol of the local dental trauma service (2014). Following the initial assessment, an informed consent form was collected. The teeth were anesthetized with local anesthesia (2% lidocaine with a vasoconstrictor; Alphacaine; DFL, Rio de Janeiro, RJ, Brazil), isolated with a rubber dam, accessed, and irrigated slowly and carefully with 6% sodium hypochlorite, which was inactivated by 5% sodium thiosulfate, followed by saline solution and 2% chlorhexidine, which was neutralized by 5% Tween-20. There was no mechanical equipment in the room. The canal was dried with absorbent paper tips. Then, with Lentulo spirals (Dentsply Maillefer, Baillaigues, Switzerland) placed 3 mm from the working length, an intracanal medication consisting of a 1:1, v/v ratio of calcium hydroxide (Biodinâmica, Ibipor, PR, Brazil) and 2% chlorhexidine gel (Endogel, Itapetininga, SP, Brazil) was inserted into the root canals. Following that, the access cavity was double-sealed with a 2-mm layer of a temporary sealing material (Coltene-Whaledent, Langenau, Germany), and resin-bonded repair (Z250 Filtek; 3M ESPE, Sumaré, SP, Brazil) was applied. The teeth were anesthetized with local anesthesia (2% lidocaine with a vasoconstrictor) at the second visit, teeth were isolated with a rubber dam, accessed, and the intracanal medication was removed using abundant irrigation with saline solution (10 mL), followed by 5 mL of 17% EDTA for 3 minutes, and then 10 mL of saline solution. To encourage bleeding, a manual K-file (Dentsply Maillefer, Baillaigues, Switzerland) was inserted 1-2mm beyond the root apex, and a 2-mm layer of collagen fiber (CollaCote; Zimmer Dental, Carlsbad, CA, USA) was put over the blood clot, followed by 3mm of white MTA (Angelus, Londrina, PR, Brazil). Finally, Coltosol (Coltene-Whaledent, Langenau, Germany) and resin-bonded repair (Z250 Filtek; 3M ESPE, Sumaré, SP, Brazil) were used to double-seal the access cavity[20, 21].

Statistical Analysis

Regarding the patient demographics, baseline characteristics, and success criteria, descriptive analyses were expressed as frequencies and percentages or the median, maximum, and lowest value.

3. Results

Descriptive analysis

Table 1: The Age of the Participants

AGE	Male	Female	Total per age
8	4	4	8
9	2	0	2
10	2	1	3
11	1	2	3
12	3	2	5
13	3	3	6
14	3	2	5
15	3	12	15
16	8	2	10
17	1	8	9
18	2	2	4
19	0	1	1
20	1	2	3
Total	33	41	74

This table 1 illustrates the frequency of the participants looking at their age and gender. It shows that their age is between 8 years and 20 years old. The total of the participants is 74 individuals divided based on their gender as follows: 33 male being 44.6% and 41 female being 55.4%. Most of females are 15 years old (30%) and males are 16 years old (24.2%) looking at the total regardless of gender; 20.2% of participants were15 years old 2.5% were 19 years old.

In addition, participants were divided based on orthodontic use, as seen in Figure 1.

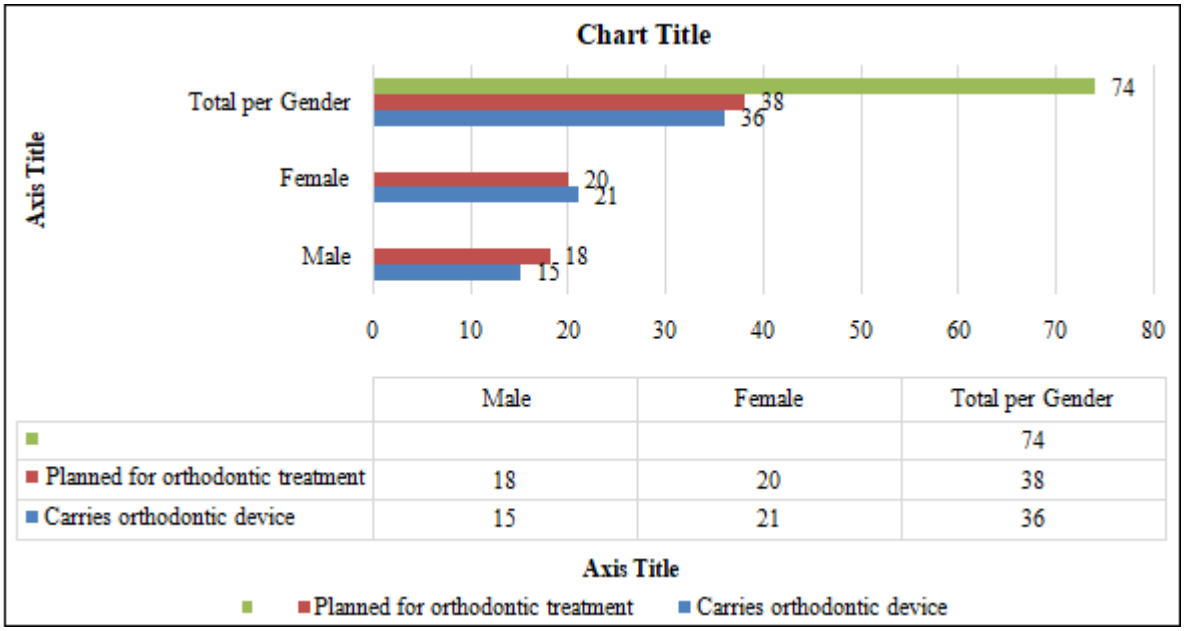

Figure 1: Orthodontic use

This figure presents the orthodontic current cases showing that 38 participants who are 51.3% of the entire sample planned to have orthodontic treatment and 48.7% carrying orthodontic devices. Accordingly, it is important to identify the types of dental trauma. This study presents the following types: intrusion, extrusion, lateral luxation, concussion, subluxation, avulsion, and crown-root fractures.

Table 2: Type of Dental Trauma

Type of dental trauma	Male	Female	Total per Type
Intrusion	8	4	12
Extrusion	6	6	12
Lateral luxation	3	7	10
Concussion	2	0	2
Subluxation	5	5	10
Avulsion	1	0	1
Crown-root fracture	5	12	17
			10
Total per gender	33	41	74

As shown in this table, the most frequent types among males were intrusion with 17.9% followed by extrusion with 13.4%; the lowest was for avulsion at 3%. For female patients, crown-root fractures were seen in30% as the most frequent type, followed by lateral luxation and avulsion, both at17%, and the lowest was for concussion and avulsion, recording no cases. Looking at the male and female participants together, it was found that 22.9% of the participants had a crown-root fracture, followed by intrusion and extrusion at16.2% for each type. The least common type was avulsion, in 1.3% of the entire sample.

It is also important to identify the severity of dental trauma as being moderate, mild, or severe. As illustrated in Figure 2, 48.6% of the entire sample had moderate dental trauma, while 25.6% were mild and 25.6% were severe.

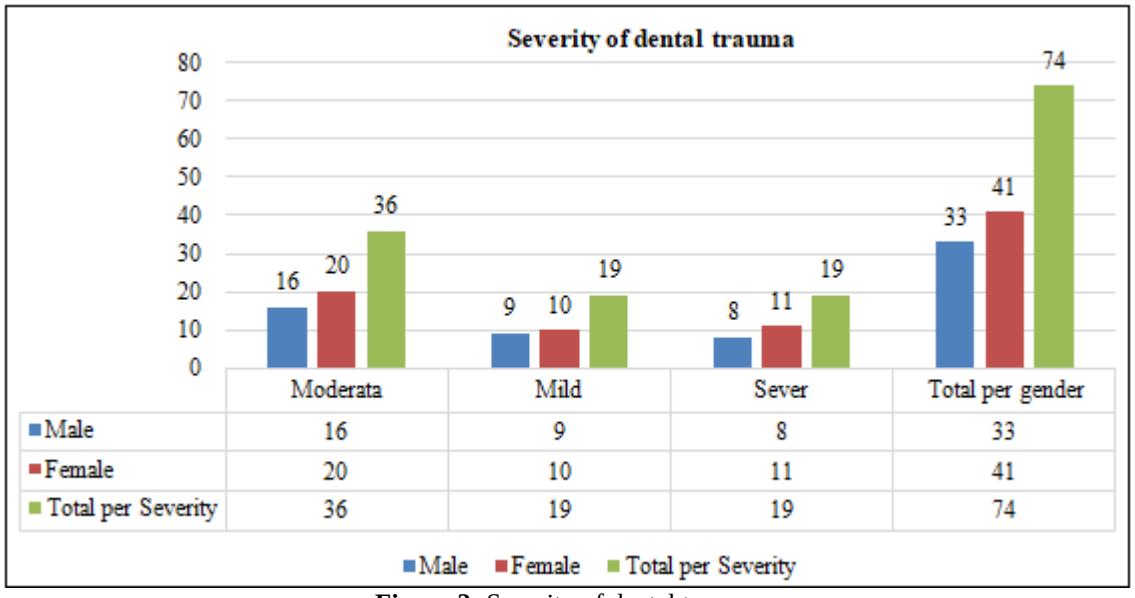

Figure 2: Severity of dental trauma

For more detail, this study also identified the number of teeth that were traumatized.

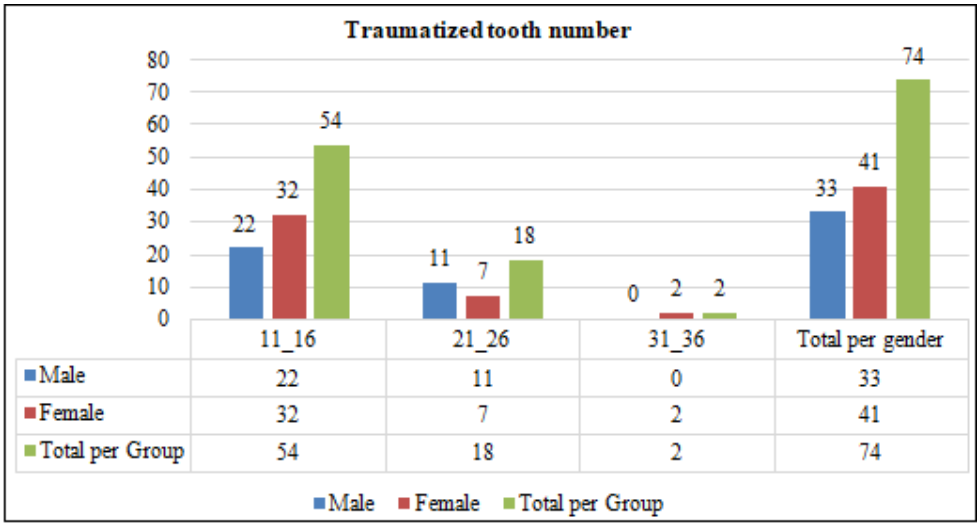

Figure 3: Number of teeth traumatized

This figure presents the number of teeth that were traumatized. Numbers are divided as follows: 11-16, 21-26, and 31-36. Numbers 11-16 are 72.9% were at the highest frequency, followed by 21-26 with 24.3% and 31-36 with 2.7%. The researchers in this study also attempted to identify the presence of infection, as shown in Figure 4.

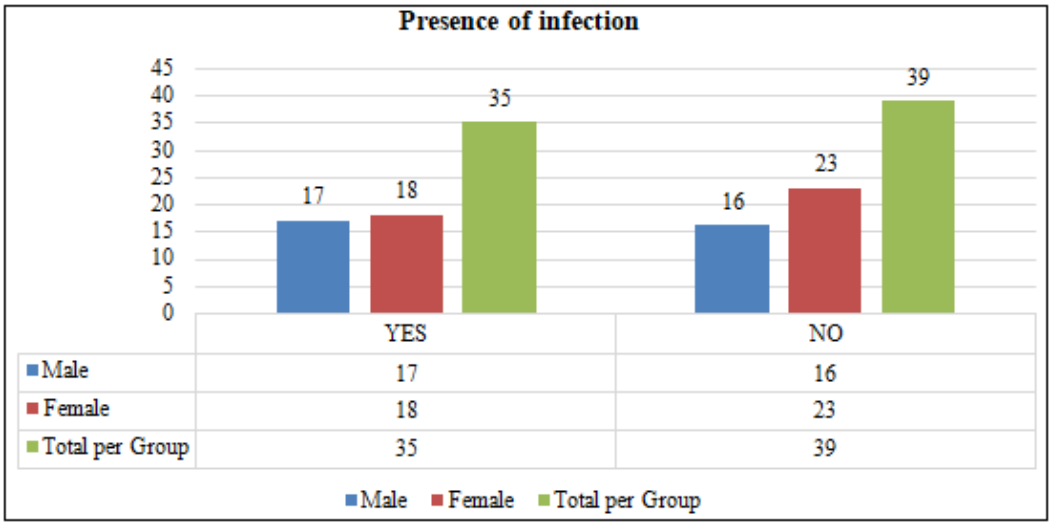

Figure 4: Presence of infection in the participants

This figure illustrates that 47.2% of the participants were infected and52.7% of them were not, showing that the frequency was similar with a slight preference for those who were not infected. Tooth apical foramen diameter in mm was also investigated.

Table 3: Tooth Apical Foramen Diameter

Tooth apical foramen diameter mm	Male	Female	Total per group
0.1-0.3	30	40	70
0.4-0.9	3	1	4
	33	41	74

In Table, 3 teeth were measured in mm as follows: 0.1-0.3 mm and 0.4-0.9 mm. In the participants, 94.5% were in the 0.1-0.3 mm group and 5.4% of the participants were in the 0.4-0.9 mm group. Additionally, this study identified the use of intracanal medication in the traumatized tooth, as shown in Figure 5.

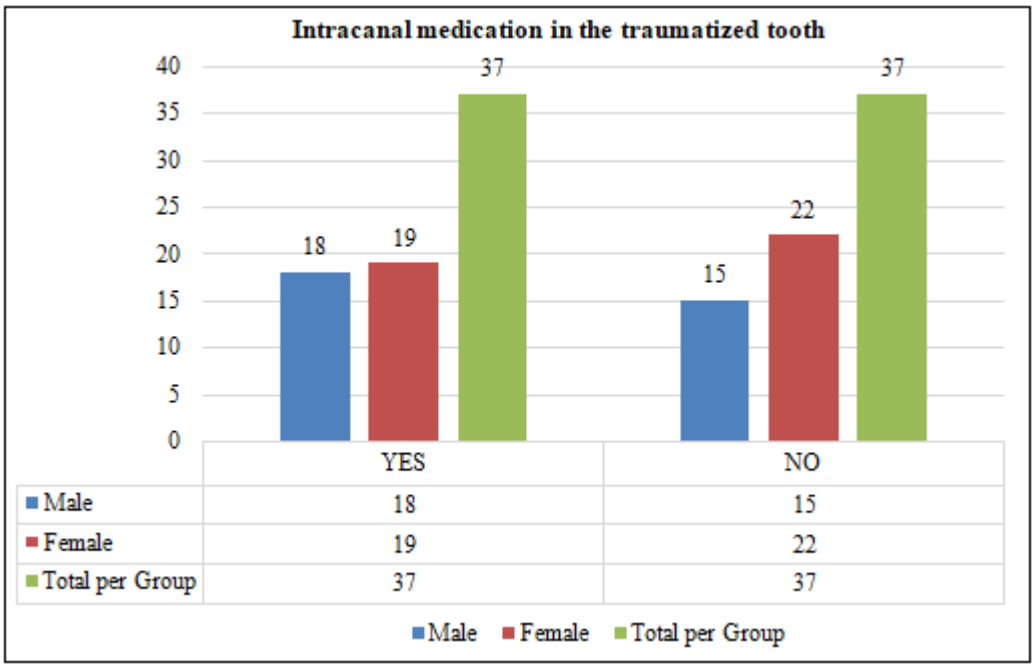

Figure 5: Intracanal medication in the traumatized tooth

In this regard, 50% of the participants had been treated with intracanal medication in the traumatized tooth and 50% of them had not been treated. Intracanal medication promotes healing and tissue repair.

Table 4: Intracanal Medication

Intracanal medication to promote healing and tissue repair	Male	Female	Total per group
Mild	0	1	1
Moderate	7	5	12
Severe	11	13	24
Total	18	19	37

This table demonstrates that there were three different measures, i.e. mild, moderate, and severe. It shows that 1.3% of the participants had a mild degree, 16.2% were moderate. and the highest proportion was severe with 32.5% all cases. The current study also assessed the status of patients treated without the local application of intracanal medication, as presented in Figure 6.

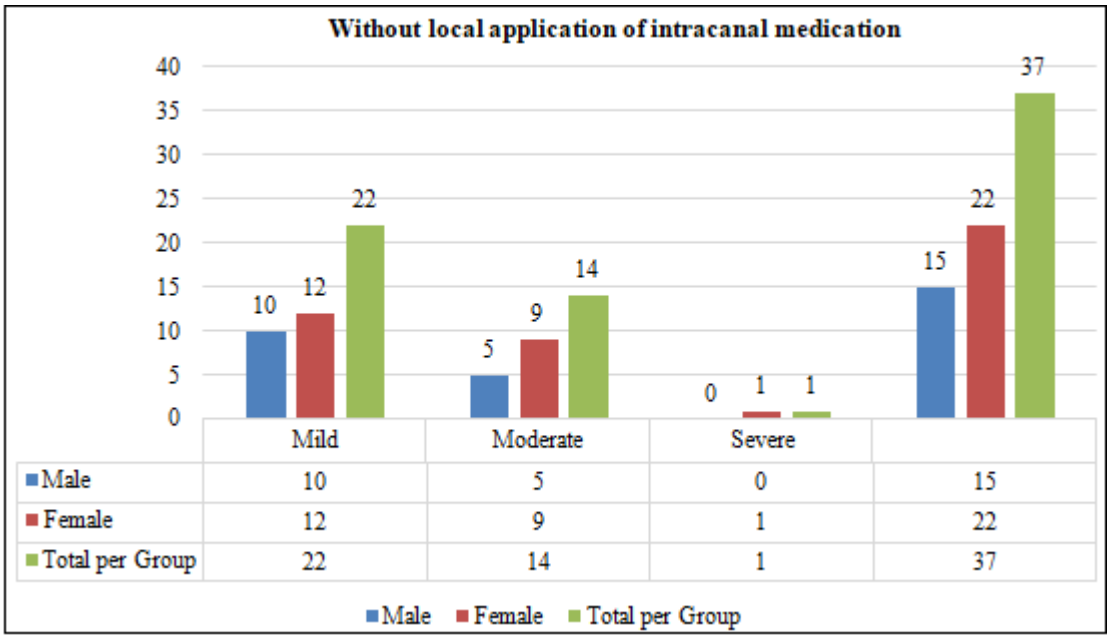

Figure 6: Status without local application of intracanal medication

Cases were assessed as mild, moderate, or severe. The results demonstrate that 29.7% of the participants were considered mild, 18.9% were moderate, and the smallest proportion was found for severe cases. In Figure 7, the local application of intracanal medication is presented.

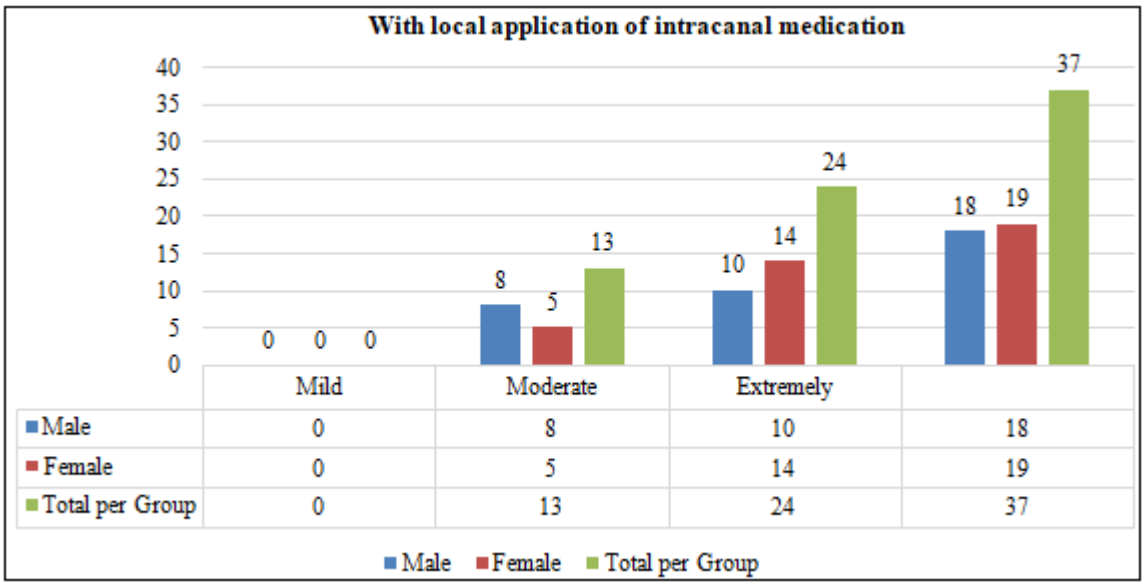

Figure 7: Local application of intracanalmedications

Application of intracanal medication may be more effective in delivering drugs were divided into the following groups: mild, moderate, and extremely. None of the cases were considered to be mild, 17.5% of the participants were found to be moderate with regard to local application of intracanal medication, and 32.4% of participants had extreme cases. As for intracanal medication in the traumatized tooth, the current study presents the table below (5).

Table 5: Intracanal medication in the traumatized tooth

Intracanal medication in the traumatized tooth	Male	Female	Total per group
YES	11	16	27
NO	2	6	8
Maybe	20	19	39
Total	33	41	74

Participants with intracanal medication in the traumatized tooth made up36.4% of the entire population. However, 10.8% of participants had not received intracanal medication in the traumatized tooth. Table 5 also shows that 52.8% of the participants may have received this treatment. The status of orthodontic forces placed on the traumatized tooth with intracanal medication is illustrated also in this study.

Table 6: Orthodontic forces placed on the traumatized tooth with intracanal medication

Orthodontic forces placed on the traumatized tooth with intracanal medication	Male	Female	Total per group
Mild	33	41	74
Moderate	0	0	0
High	0	0	0
Total	33	41	74

Table 6 presents all cases with regard to placing orthodontic forces on the traumatized tooth with intracanal medication; 100% of cases were mild. There were no moderate and high cases. The study also examined cases with the presence of resorption with intracanal medication.

Table 7: Cases of resorption with intracanal medication

Presence of resorption With intracanal medication	Male	Female	Total per group
Mild	29	39	68
Moderate	4	2	6
Sever	0	0	0
Total	33	41	74

All cases of the participants in this table divided between mild and moderate, with no recorded severe cases. More deeply, it shows that 91.9% of the cases were mild and 8.1% of them were moderate. This study also investigated cases of resorption without intracanal medication.

Table 8: Presence of resorption without intracanal medication

Presence of resorption without intracanal medication	Male	Female	Total per group
Mild	0	0	0
Moderate	13	16	29
Severe	20	25	45
Total	33	41	74

In this table, all cases were moderate or severe, i.e. 39.2% of participants were considered moderate cases, while 60.8% were recorded as severe. This table shows that none of the cases were found to be mild.

4. Discussion

The age of the participants of this study was between 8 years and 20 years old, including 74 individuals (33 males and 41 females). All the analyses divided the findings or/and cases based on gender. Moreover, 45.9% of the participants were 15 to 17 years old. This age range agrees with studies[22] indicating that young people are often those who need endodontic/ orthodontic treatment of traumatized teeth using intracanal medication. The present study included many cases of such treatments, such as finding those who were planning for orthodontic treatments and others who had orthodontic devices. Moreover, we identified the type of dental trauma, and presented the severity of dental trauma, the number of teeth traumatized, the presence of infection,

the tooth apical foramen diameter, the use of intracanal medication in the traumatized tooth and cases with/without intracanal medication to promote healing and tissue repair of. We furthermore assessed the status of being with/without local application of intracanal medication, intracanal medication use in the traumatized tooth, orthodontic forces placed on the traumatized tooth with intracanal medication, and cases of resorption with/without intracanal medication.

In this study, it is important to highlight that 72.7% of the male subjects' showed intrusion, extrusion, subluxation, and crown-root fractures. With regard to female subjects, most types (63.4%) were as follows: crown-root fracture, avulsion, and lateral luxation; that most cases were of the crown-root fracture type in 16.2% of female participants and 6.7% of male participants. Regarding the severity of dental trauma, females were more in all cases. It was found that 27% of female participants were at a moderate severity, while 21.6% of moderate cases were male. As for mild severity, this was seen in 13.5% of female participants and 12.1% of male participants; 14.8% of the female participants were considered severe, as were 10.8% of male participants. Tooth number was as follows: 43.2% of female participants were in the category (11-16) being, as were 29.7% of the male participants. None of the male participants were within the category of (31-36), and only 1.3% of females were within this group. Regarding the group of (21-26), this was seen in 14.8% of male participants and 9.4% of female participants.

Regarding infection, 24.3% of female participants were affected, as were 22.9% of male participants. However, 31% of female and 21% of male participants were not infected and 25.6% of female and 24.3% of male were treated with intracanal medication in the traumatized tooth, while 29.7% of female and 20.2% of male participants were not. With regard to the local application of intracanal medication, 16.2% of female and 13.5% of male participants did not receive local application of intracanal medication, measuring to be mild. On the contrary, none of male and female participants were within the category of having local application of intracanal medication measured to be mild. In addition, 12.1% of female and 6.7% of male participants were considered moderate without local application of intracanal medication. None of the male participants was recorded as severe without local application of intracanal medication, as were only 1.3% of female participants. This study also examined the local application of intracanal medication and it shows that moderate measurement has presented that 10.8% of male and 6.7% of female were recorded. In regard to severe extremely, 18.9% of female and 13.5% of male with locally applying intracanal medication were recorded.

Most of the participants were not certain whether they had received intracanal medication in the traumatized tooth, including27% of male and 25.6% of female participants; 14.8% of male and 21.6% of female participants had received intracanal medication in the traumatized tooth, while 2.7% of male and 8.1% of female participants did not receive intracanal medication in the traumatized tooth. With regard to placing orthodontic forces on the traumatized tooth with intracanal medication, 0% of male and female participants were observed in the measurement scale of moderate and high, while 44.6% of male and 54.4% of female had orthodontic forces on the traumatized tooth with intracanal medication. In the presence of resorption with intracanal medication, 0% of both male and female participants showed this, while 5.4% of male and2.7% of female participants were recorded as being moderate. However, 39.1% of male and 52.7% of female participants were being recorded. On the contrary, 0% of male and female participants showed the presence of resorption without intracanal medication, and17.5% of male and21.6% of female participants were considered moderate. As for severe cases, it was seen that 27% of male and 33.7% of female participants were included.

5. Conclusion

Endodontic orthodontic treatment of traumatized teeth using intracanal medication plays a key role in the treatment of traumatic dental injuries and is strongly associated with the outcome, particularly in severe cases. The correct diagnosis and treatment are essential to forming a basis for developing the appropriate management strategy. However, many cases of endodontic/orthodontic treatment of traumatized teeth using intracanal medication are complex, and treatment requires a profound knowledge of the physiological and pathological responses of the affected tissues. These descriptive findings were compiled in response to research indicating the need for additional training and education in the treatment of traumatized teeth by orthodontists. The treatment of traumatized teeth is a problem that orthodontists face on a daily basis. It is critical for orthodontists to understand the many types of trauma, how they are treated, and how they affect treatment.

References

[1] Ebeleseder K (1994) A suggestion of a new classification systemof traumatic dental injuries. Endodontics and Dental Traumatology 10, 39.
[2] Filippi A, Tschan J, Pohl Y, Berthold H, Ebeleseder K (2000)A retrospective classification of tooth injuries using a newscoring system. Clinical Oral Investigations 4, 173-5.
[3] Andreasen JO, Andreasen FM, Andersson L (2018) Textbookand Color Atlas of Traumatic Injuries to the Teeth, 5thedn.Oxford: Wiley Blackwell.
[4] Andreasen FM, Andreasen JO (1985) Diagnosis of luxation injuries: the importance of standardized clinical, radiographic and photographic techniques in clinical investigations. Endodontics and Dental Traumatology 1, 160-9.
[5] Bakland LK, Andreasen JO (2004) Dental traumatology: essential diagnosis and treatment planning. Endodontic Topics, 7(1), 14-34.
[6] Andreasen FM (1989) Pulpal healing after luxation injuries and root fracture in the permanent dentition. Dental Traumatology, 5(3), 111-131.
[7] Reddy LV, Bhattacharjee R, Misch E, Sokoya M, Ducic Y (2019) Dental injuries and management. Facial Plastic Surgery, 35(06), 607-613.
[8] Bourguignon C, Cohenca N, Lauridsen E, et al. (2020) InternationalAssociation of Dental

Traumatology guidelinesfor the management of traumatic dental injuries: 1. Fracturesand luxations. Dental Traumatology 36, 314-30.

[9] Day P, Flores MT, O'Connell A, et al. (2020) InternationalAssociation of Dental Traumatology guidelines forthe management of traumatic dental injuries: 3. Injuriesin the primary dentition. Dental Traumatology 36, 343-59.

[10] Fouad AF, Abbott PV, Tsilingaridis G, et al. (2020) InternationalAssociation of Dental Traumatology guidelines forthe management of traumatic dental injuries: 2. Avulsionof permanent teeth. Dental Traumatology 36, 331-42.

[11] Abbas A, Kethineni B, Puppala R, Birapu UC, Raghavendra KJ, Reddy P (2020) Efficacy of mineral trioxide aggregate and biodentine as apical barriers in immature permanent teeth: a microbiological study. International Journal of Clinical Pediatric Dentistry, 13(6), 656.

[12] Siddiqui Z, Acevedo-Jake AM, Griffith A, et al. (2021) Cells and material-based strategies for regenerative endodontics. Bioactive Materials.

[13] Beslot-Neveu A, Bonte E, Baune B, et al. (2011). Mineral trioxide aggregate versus calcium hydroxide in apexification of non-vital immature teeth: Study protocol for a randomized controlled trial. Trials, 12(1), 1-8.

[14] Wigler R, Kaufman AY, Lin S, Steinbock N, Hazan-Molina H, Torneck CD (2013) Revascularization: a treatment for permanent teeth with necrotic pulp and incomplete root development. Journal of Endodontics, 39(3), 319-326.

[15] Hoshino E, Kurihara-Ando N, Sato I, et al. (1996). In-vitro antibacterial susceptibility of bacteria taken from infected root dentine to a mixture of ciprofloxacin, metronidazole and minocycline. International Endodontic Journal, 29(2), 125-130.

[16] Mohammadi Z, Abbott PV (2009) On the local applications of antibiotics and antibiotic-based agents in endodontics and dental traumatology. International Endodontic Journal, 42(7), 555-567.

[17] Goldberg M (2020) Antibiotics and antibacterial medications for endodontic treatments, JSM Dent 8(2), 11-24.

[18] Saoud TMA, Zaazou A, Nabil A, Moussa S, Lin LM, Gibbs JL (2014) Clinical and radiographic outcomes of traumatized immature permanent necrotic teeth after revascularization/revitalization therapy. Journal of Endodontics, 40(12), 1946-1952.

[19] Nagata JY, Soares AJ, Souza-Filho FJ, et al. (2014) Microbial evaluation of traumatized teeth treated with triple antibiotic paste or calcium hydroxide with 2% chlorhexidine gel in pulp revascularization. Journal of Endodontics, 40(6), 778-783.

[20] Pereira AC, Oliveira MLD, Cerqueira-Neto ACC, et al. (2020) Treatment outcomes of pulp revascularization in traumatized immature teeth using calcium hydroxide and 2% chlorhexidine gel as intracanal medication. Journal of Applied Oral Science, 28.

[21] Chan EKM, Desmeules M, Cielecki M, Dabbagh B, Dos Santos BF (2017) Longitudinal cohort study of regenerative endodontic treatment for immature necrotic permanent teeth. Journal of Endodontics, 43(3), 395-400.

[22] Sandler C, Al-Musfir T, Barry S, et al. (2021) Guidelines for the orthodontic management of the traumatised tooth. Journal of Orthodontics, 48(1), 74-81.