

Evaluation of the Effect of Delayed Management of Traumatized Permanent Teeth

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This investigation studied the complication that could arise from delayed management of traumatized permanent teeth. Patients reported to the primary care clinic at the College of Dentistry, King Saud University, seeking treatment of traumatized anterior teeth were evaluated. Esthetic consideration (64 patients) and pain, swelling, or discomforts (50 patients) were the main reasons the patients came to the clinic. Clinical and radiographic examinations, as well as history of the trauma, were recorded. It was found that most of the patients had a treatment delay exceeding 1 month. Initial pulp exposure resulted in 100% pulp necrosis. When a fracture involved both enamel and dentin, the frequency of pulp necrosis was 53%. External root resorption and pulp calcification were seen in few teeth. It was concluded that the figures for pulp necrosis could be misleading, because there might have been a bias when only patients with problems sought treatment. In addition, a trauma awareness educational program should be developed to encourage parents and the public to seek immediate dental treatment. Furthermore, a proper diagnostic test for pulp and periodontal complication should be done in patients with initially nontreated dental injuries.

Impact injuries are frequent in both the primary and permanent dentitions. The mineralized tooth structure, dental pulp, periodontium, and the supporting bone may be affected. This can result in a number of complications, such as pulp necrosis, pulp canal obliteration, root resorption, and loss of marginal attachment (1-7).

Early management and regular follow-up of traumatized teeth may reduce such complications. In Table 1, the prevalence of pulp necrosis in different types of dental injuries is presented. This table represents studies in which patients have received early treatment after injury. It is not known how lack of treatment will affect the long-term prognosis of trauma.

The purpose of this study was, therefore, to evaluate the com-

TABLE 1. Prevalence of pulp necrosis after dental injury

| Type of Injury | Investigator (Ref.) | No. of Teeth | Pulp Necrosis (%) |
|-------------------|----------------------|--------------|-------------------|
| Enamel fracture | Ravn (11) | 2862 | 1 |
| Enamel and dentin | Ravn (12) | 3044 | 3 |
| Pulp exposure | Cvek (14) | 60* | 4 |
| Root fracture | Zachrisson (15) | 64 | 20 |
| Lateral luxation | Andreasen (4) | 122 | 58 |
| Extrusion | Andreasen (4) | 53 | 26 |
| Intrusion | Andreasen et al. (7) | 61 | 85 |

* Teeth were treated by calcium hydroxide pulpotomy or pulp capping.

plications that might arise from delayed management of traumatized permanent teeth.

MATERIALS AND METHODS

One hundred and fourteen patients who reported to the primary care clinic at the College of Dentistry, King Saud University, seeking treatment of traumatized anterior teeth were studied.

The reasons for seeking treatment were in 64 cases esthetic consideration and in 50 cases pain, swelling, or complaint of discomfort. The patient's age, sex, and when, where, and how the trauma occurred were recorded as well as dental and medical histories.

The injured teeth were examined clinically for the presence of discoloration of the crown and tenderness to percussion, as well as reaction to cold. Furthermore, electrometric sensibility testing was performed using an Analytic Technology Pulp Tester. In addition, a radiographic examination for the presence of root resorption and/or bone loss was performed using a standard periapical bisecting angle exposure of the traumatized teeth.

RESULTS

Male patients represented 47% and female patients 53% of the trauma sample. The causes of trauma are shown in Table 2. Most of the traumas were related to fall injuries (54%). Others injuries included car accidents and injuries such as hitting a hard object.

The maxillary central incisors were the most frequently injured tooth (Table 3). The majority of the patients were traumatized

TABLE 2. Etiology of dental trauma according to sex ($n = 114$)

| | Sex | | Total | % |
|---------------|------|--------|-------|------|
| | Male | Female | | |
| Falls | 27 | 35 | 62 | 54.4 |
| Contact sport | 5 | 0 | 5 | 4.4 |
| Fights | 8 | 12 | 20 | 17.5 |
| Other causes | 14 | 13 | 27 | 23.7 |

TABLE 3. Location of traumatized teeth

| | Maxilla | | Mandible | | Total | % |
|------------------|---------|------|----------|------|-------|------|
| | | % | | % | | |
| Central incisors | 171 | 75 | 17 | 7.5 | 188 | 82.5 |
| Lateral incisors | 25 | 11 | 9 | 4 | 34 | 15 |
| Others | 2 | 0.9 | 4 | 1.8 | 6 | 2.7 |
| Total | 198 | 86.8 | 30 | 13.2 | 228 | |

TABLE 4. Sex and age distribution of 114 consecutive traumatic dental injuries

| Age (yr) | Sex | |
|----------|------|--------|
| | Male | Female |
| 6-8 | 2 | 2 |
| 9-11 | 20 | 22 |
| 12-14 | 16 | 18 |
| ≥15 | 16 | 18 |
| Total | 54 | 60 |

TABLE 5. Reported time since injury and reason for seeking treatment after dental injuries

| Reported Time Since Injury | Reason for Seeking Treatment | | | | Total |
|-------------------------------|------------------------------|--------|----------|--------|-------|
| | Esthetic | | Symptoms | | |
| | Male | Female | Male | Female | |
| 0-1 wk | 3 | 1 | 5 | 4 | 13 |
| 2-4 wk | 3 | 2 | 3 | 1 | 9 |
| 1-6 months | 9 | 8 | 4 | 5 | 25 |
| 7-12 months | 3 | 4 | 3 | 2 | 12 |
| 1-4 yr | 9 | 15 | 5 | 9 | 34 |
| 5-10 yr | 2 | 5 | 5 | 4 | 15 |
| Total | 29 | 35 | 25 | 25 | 114 |

between the ages of 9 to 11 (Table 4), and most of the patients had a treatment delay exceeding 1 month (Table 5). Furthermore, esthetic reasons were as frequent as symptoms for seeking treatment (Table 5). In addition, there was a relationship between seeking treatment and development of pulp necrosis.

Initial pulp exposure resulted in 100% pulp necrosis, whereas fractures where both enamel and dentin were involved showed a frequency of 53% pulp necrosis (Table 6). Few teeth had crown-root fractures. Pulp calcification was seen in only a few teeth, mostly of intact crown (Table 6).

External root resorption was seen in 18 teeth (Table 7).

DISCUSSION

The cause of most dental injury among the examined cases was a fall, a finding similar to other investigators (1, 8). Dental injuries caused by road traffic accidents reported to the dental school were very few; only five cases were recorded. This may be because road

traffic accidents in Saudi Arabia are usually seen at General Central Hospitals because of police involvement.

Most of the cases were seen in 9- to 11-yr-old individuals. The time of reporting to the dental clinic for dental treatment varied and often exceeded 1 to 4 yr. This means that most of the cases received trauma between the ages of 6 to 8 years. This agrees with the observation of Andreasen (9). He related that to the vigorous play characteristic of that age group. Some parents believed that the injury was confined to primary dentition, which was going to be replaced by permanent ones later. This could explain the high number of reported cases between the ages of 9 to 11 yr. Three cases reported late from villages around Riyadh because there was no available dentist.

The reason for seeking dental treatment after dental injury was because of esthetic or clinical symptoms, such as pain and swelling (10). Esthetic reason was found to be slightly more frequent than symptoms. Most of the patients seeking esthetic correction had developed pulp necrosis in addition to enamel fracture (Table 6). The maxillary central incisor was the most frequently injured tooth. This finding was reported by other investigators (8, 9). They suggested several predisposing factors, such as increased overjet, insufficient lip closure, and protrusion of upper incisors (9). This was also observed in this study.

Enamel fracture normally represents a minimal risk to the pulp tissue. Ravn (11) reported a 1% frequency of pulp necrosis in 2862 teeth with enamel fracture only. In the present study, 2 of 20 teeth showed necrosis; however, both teeth had suffered an associated luxation injury.

Ravn (12) reported a 3.2% pulp necrosis of 3044 examined teeth involving both enamel and dentin, but without pulp involvement. The present investigation showed a 53% frequency of pulp necrosis, and 6 teeth (7%) showed external root resorption. An explanation for the high frequency of pulp necrosis recorded after fracture could be leaving the dentin uncovered with bacteria invasion through the open dentinal tubules leading to pulp necrosis (13). Early treatment of pulp exposure using calcium hydroxide in the form of either pulp capping or pulpotomy has been reported to have good prognosis regarding pulp healing (2, 14). The delay in treatment by patients with pulp exposures in this study caused a frequency of 100% pulp necrosis. Furthermore, external root resorption was observed in four teeth. This event could be related to the necrosis of the pulp tissue and the long-standing periapical pathosis that was observed radiographically in some of the cases. In addition, the teeth could have had a combined luxation injury that was not known to us. Pulp necrosis following root fractures has been found to occur in 20 to 44% of cases (3, 15, 16). In the present study, it was found in 100% of cases of crown-root fractures and in 43.7% of horizontal root fractures.

Luxation injuries can be either concussion, subluxation, lateral luxation, intrusion, or avulsion. These types of trauma usually involve both pulp and periodontium. Pulp necrosis, pulp canal obliteration, and root resorption following luxation injuries have been reported by several investigators (4-6, 17). The late appearance of patients made a correct diagnosis of luxation injuries difficult and somewhat impossible.

Late management of impact dental injuries seems to lead to a high frequency of pulp necrosis. Based on the results of this investigation, a trauma awareness educational program should be developed to encourage parents and the public to seek immediate dental treatment. Furthermore, a proper diagnostic test for pulp and periodontal complications should be done in patients with initially nontreated dental injuries.

TABLE 6. Frequency of pulp necrosis/calcification after dental injury and the related reason for seeking treatment

| Type of Injury | No. of Teeth | Pulp | | | | Reason for Seeking Treatment | |
|---------------------|--------------|------|------|-------|------|------------------------------|-------|
| | | Nec. | % | Calc. | % | Esth. | Symp. |
| Intact crown | 49 | 19 | 38.8 | 5 | 10.2 | 31 | 18 |
| Crown fracture | | | | | | | |
| Enamel only | 20 | 2 | 10 | 0 | 0 | 8 | 12 |
| Enamel and dentin | 88 | 47 | 53.4 | 2 | 0 | 42 | 46 |
| Pulp exposure | 51 | 51 | 100 | 0 | 0 | 31 | 20 |
| Crown-root fracture | 4 | 4 | 100 | 0 | 0 | 2 | 2 |
| Root fracture | 16 | 7 | 43.7 | 1 | 0 | 10 | 6 |

Nec., necrosis; Calc., calcification; Esth., esthetic; Symp., symptoms.

TABLE 7. Frequency of root resorption after dental injury

| Type of Injury | No. of Teeth | Resorption | | | |
|---------------------|--------------|------------|-----|----------|-----|
| | | Internal | % | External | % |
| Intact crown | 49 | 1 | 2 | 4 | 8.2 |
| Crown fracture | | | | | |
| Enamel only | 20 | 0 | 0 | 1 | 5 |
| Enamel and dentin | 88 | 1 | 1.1 | 6 | 6.8 |
| Pulp exposure | 51 | 0 | 0 | 4 | 7.8 |
| Crown-root fracture | 4 | 0 | 0 | 0 | 0 |
| Root fracture | 16 | 0 | 0 | 0 | 0 |

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