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Dental trauma trends in emergency care: a comparative analysis before, during, and after COVID-19

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Abstract (J Korean Assoc Oral Maxillofac Surg 2023;49:339-346)

Objectives: This analysis details the characteristics of dental trauma in South Korea during the coronavirus disease 2019 (COVID-19) (DC) pandemic and compares them in patients before and after COVID-19 (BC and AC, respectively).

Materials and Methods: Data were collected from medical records of patients who visited Seoul National University Bundang Hospital's Emergency Dental Care Center during three 12-month periods: BC, DC, and AC (BC from March 1, 2019 to February 29, 2020; DC from March 1, 2020 to February 28, 2021; AC from March 1, 2022 to February 28, 2023). A retrospective review was conducted to investigate patient age, sex, time of visit, cause, and diagnosis. The study included 1,544 patients: 660 BC, 374 DC, and 510 AC.

Results: Significant difference in age and sex was not observed among the three periods; 1-9 years of age was the largest group (38.3% in BC, 29.6% in DC, and 27.8% in AC), and the percentage of male patients was greater than of female patients (male proportion as 63.5% in BC, 67.4% in DC, and 64.9% in AC). The number of patients generally peaked at a Saturday night in spring (for BC: May, Saturday, 18:00-19:59; for DC: March, Saturday, 18:00-19:59; for AC: April as the second most (October as the most peaked), Saturday, 20:00-21:59). The primary etiology of the dental trauma was identical in the three periods: falls, followed by sports. The most frequent diagnosis was laceration, followed by tooth avulsion and jaw fracture.

Conclusion: Significant differences were not found between the characteristics and patterns of dental trauma in the BC, DC, and AC periods. However, due to the pandemic and social distancing, activities decreased and associated dental trauma-related incidents declined.

Key words: COVID-19, Tooth injuries, Emergency treatment, Tooth avulsion, Sports medicine

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I. Introduction

In December 2019, the world witnessed the emergence of a health crisis triggered by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1]. South Korea was among the first nations to confront related challenges and officially reported its first case on January 20, 2020. In response to a rapid escalation in daily confirmed cases by the end of February, the Korean government implemented stringent travel restrictions, mandated self-quarantine and social distancing measures, prohibited gatherings, suspended operations of high-risk facilities, modified school attendance schedules, and promoted telecommuting[2]. Although some of these restrictions were relaxed in May 2020, public participation in social and outdoor activities continued to decline due to persistent concerns regarding the disease[3]. In many countries, this shift in societal behavior was accompanied by a notable decrease in the incidence of dental injuries associated with traumatic events[4].

Dental injuries, commonly associated with social and physical activities, typically occur in children during sports or activities and among adults during leisure or outdoor pursuits. The unique context of the coronavirus disease 2019 (COVID-19) pandemic and the resultant restrictions on social activities were anticipated to significantly affect the incidence of dental injuries. Although extensive data on dental emergencies during the pandemic have been reported in China, France, and the UK, the effects of COVID-19 on traumatic dental injuries in South Korea remain less understood[4-9].

This study aims to investigate and analyze the characteris-

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tics of traumatic dental injuries treated at an Emergency Dental Care Center in South Korea during the 2020 COVID-19 pandemic. The data were compared with incidents of traumatic dental injuries from equivalent periods before and after the pandemic to all analysis of the effects of the pandemic on this specific health issue.

II. Materials and Methods

Data for this study were systematically extracted from the electronic medical records of patients at the Seoul National University Bundang Hospital's Emergency Dental Care Center across three distinct 12-month periods, before COVID-19 (BC), during COVID-19 (DC), and after COVID-19 (AC). The BC cohort was comprised of patients who visited the hospital between March 1, 2019, and February 29, 2020. The DC cohort included patients from March 1, 2020, to February 28, 2021. Due to the continued influence of the pandemic during March 1, 2021 to February 28, 2022, the AC cohort consisted of patients from March 1, 2022 to February 28, 2023.

A thorough review of medical records from March 2019 to February 2023 was performed in this retrospective study. Patient data were collected and included variables such as day of the week, time of visit, age, sex, trauma cause, and diagnoses by the on-call clinicians. The dental traumas investigated were enamel fractures without dentin exposure (Ellis I), enamel-dentin fractures without pulp exposure (Ellis II), enamel-dentin fractures with pulp involvement (Ellis III), crown-root fractures, and various periodontal tissue injuries. The latter category was further subdivided into subluxation, lateral luxation, intrusion, extrusion, and tooth avulsion. In addition, cases involving lacerations and jaw fractures were included. The etiology of the injuries was classified into falls, traffic accidents, violence, sports-related injuries, industrial accidents, e-kickboard incidents, dog bites, and fainting episodes.

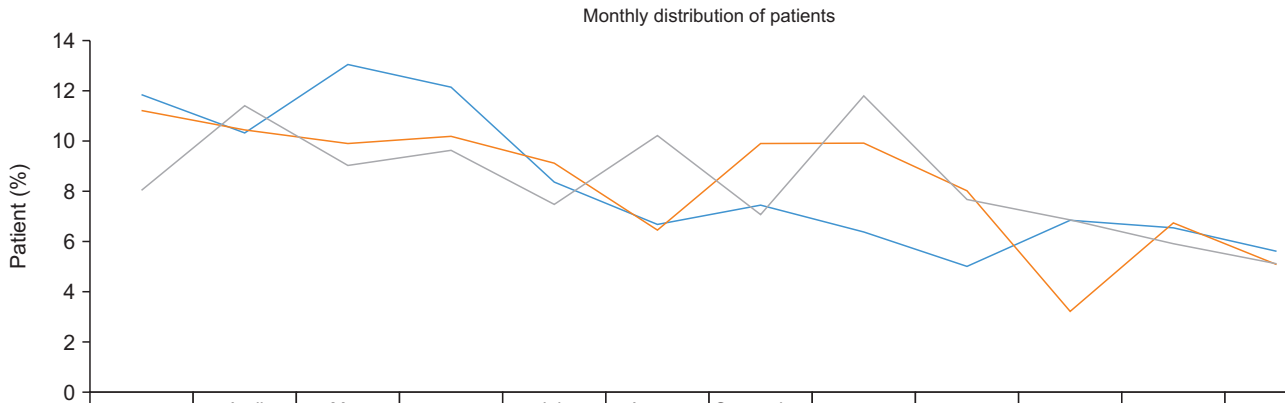
For statistical analysis, ANOVA was used with a significance threshold of 0.05. Data processing and analysis were conducted using Python (ver. 3.8.10; Python Software Foundation) and IBM SPSS Statistics (ver. 27.0; IBM), facilitating both descriptive and correlational analyses.

Ethical clearance for this research was obtained from the Institutional Review Board of Seoul National University Bundang Hospital (IRB No. B-2205-756-109).

III. Results

1. Temporal patterns in trauma incidence

The incidence of dental trauma significantly declined following the onset of COVID-19, with the number of patients decreasing from 660 BC to 374 DC and then partially rebounded to 510 AC. Specifically, a 43.3% reduction in patient visits occurred in the DC period compared with the BC period, with a subsequent 36.1% increase in the AC period



	March	April	May	June	July	August	September	October	November	December	January	February
BC	11.8%	10.3%	13.0%	12.1%	8.3%	6.7%	7.4%	6.4%	5.0%	6.8%	6.5%	5.6%
DC	11.2%	10.4%	9.9%	10.2%	9.1%	6.4%	9.9%	9.9%	8.0%	3.2%	6.7%	5.1%
AC	8.0%	11.4%	9.0%	9.6%	7.5%	10.2%	7.1%	11.8%	7.6%	6.9%	5.9%	5.1%

Fig. 1. The percentage of patient visits in each month before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)

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compared with the DC period, both of which were statistically significant (P<0.05). A consistent temporal trend was observed across all periods.(Fig. 1) Fewer patient visits were consistently recorded in February; 5.6% BC, 5.1% DC, and 5.1% AC, and an increase in visits was observed in spring. The highest number of patient visits across all periods occurred on Saturdays (19.2% BC, 22.5% DC, and 19.6% AC). (Fig. 2) Furthermore, a general increase in visits from weekdays to weekends was observed. The peak hours for visits were after 18:00, while and a significant decline in visits occurred after 02:00.(Fig. 3)

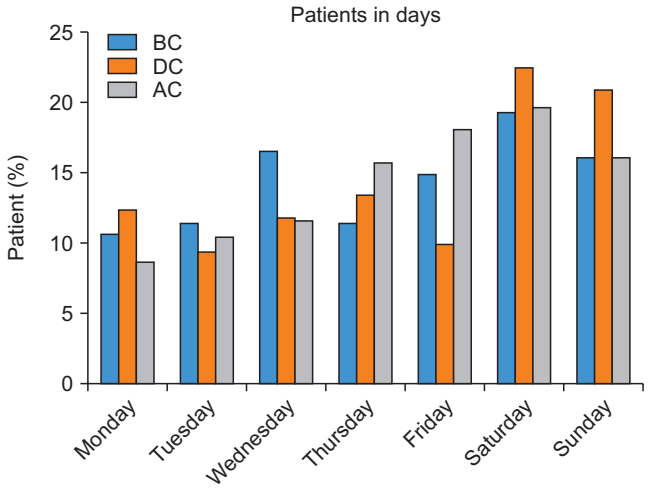

Fig. 2. The percentage of patient visits in each day before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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2. Demographic distribution of patients

The sex distribution among patients was relatively consistent, with males comprising a larger proportion (63.5% BC, 67.4% DC, and 64.9% AC).(Fig. 4) However, significant sex-based difference was not observed in specific diagnoses (P>0.05). In terms of age, patients 1-9 accounted for the highest proportion of cases (38.3% BC, 29.6% DC, and 27.8% AC), followed by patients 20-29 and 40-49 years.(Fig. 5) Notably, Ellis I injuries showed significant differences in patients 20-29 years of age between the BC and DC periods (P<0.05), and crown-root fractures differed significantly in patients 40-49 years of age between DC and AC periods (P<0.05).

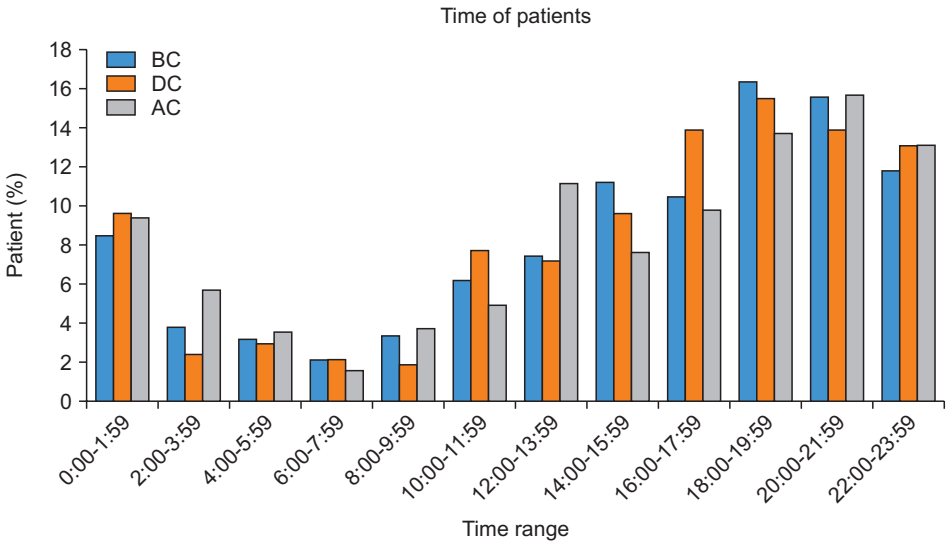

Fig. 3. The percentage of patients visited in each time range before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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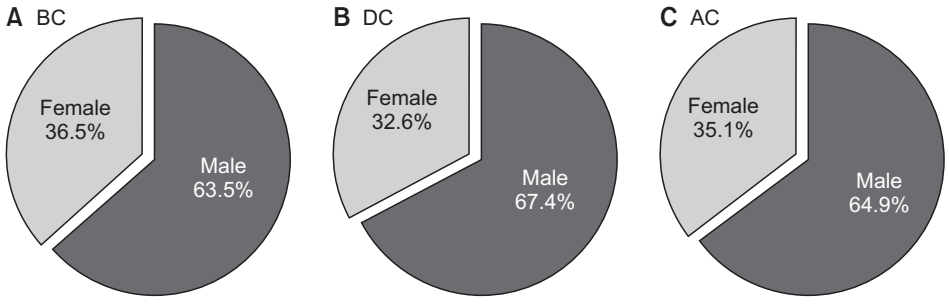

Fig. 4. The percentage of patients' sex distribution before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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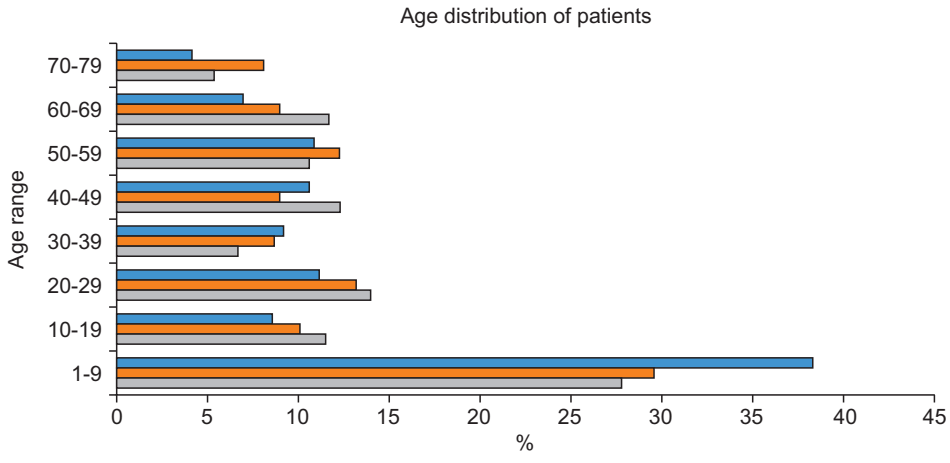

	1-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79
BC	38.3%	8.6%	11.2%	9.2%	10.6%	10.9%	7.0%	4.2%
DC	29.6%	10.1%	13.2%	8.7%	9.0%	12.3%	9.0%	8.1%
AC	27.8%	11.5%	14.0%	6.7%	12.3%	10.6%	11.7%	5.4%

Fig. 5. The percentage of patients' age distribution before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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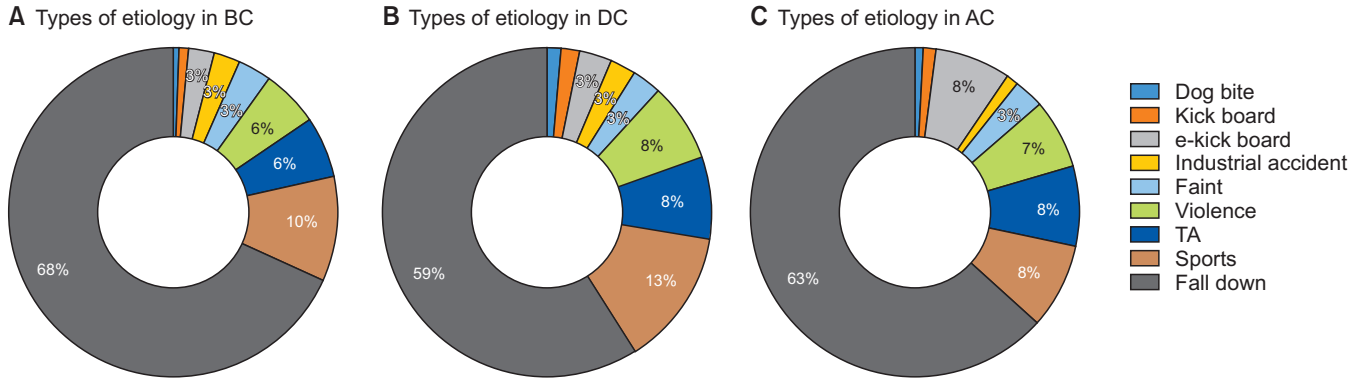

Fig. 6. The percentage of etiology of patients before, during, and after coronavirus disease 2019 (COVID-19). (TA: traffic accident, BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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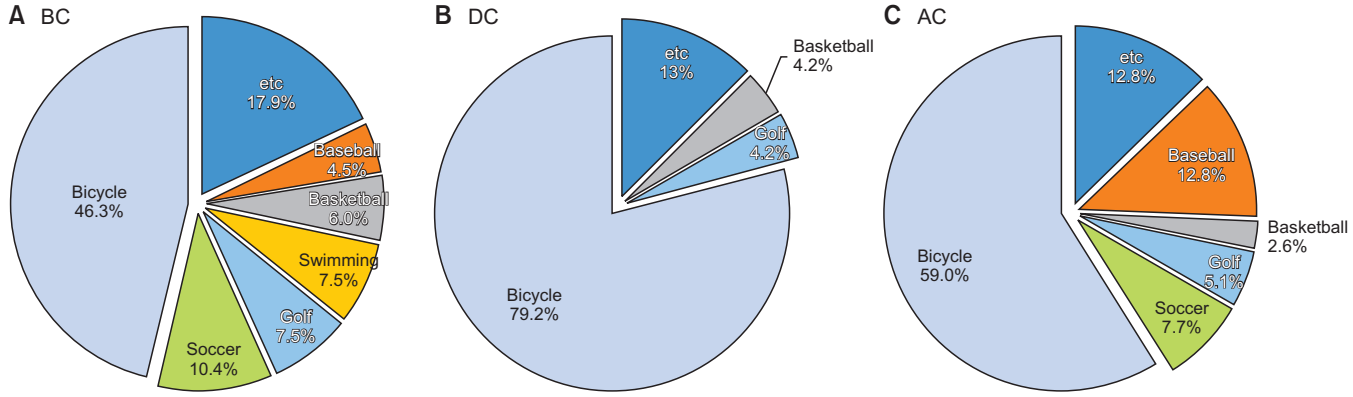

Fig. 7. Types of sports that cause trauma to patients before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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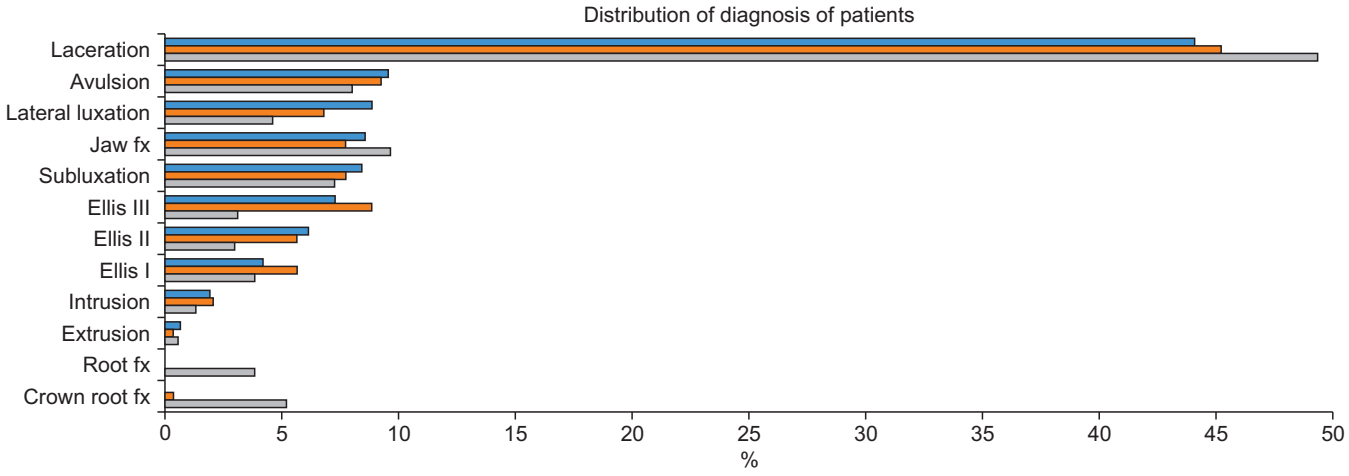

	Crown root fx	Root fx	Extrusion	Intrusion	Ellis I	Ellis II	Ellis III	Subluxation	Jaw fx	Lateral luxation	Avulsion	Laceration
BC	0%	0%	0.7%	1.9%	4.2%	6.2%	7.3%	8.4%	8.6%	8.9%	9.6%	44.2%
DC	0.4%	0%	0.4%	2.1%	5.7%	5.7%	8.9%	7.8%	7.8%	6.8%	9.3%	45.3%
AC	5.2%	3.9%	0.6%	1.3%	3.9%	3.0%	3.1%	7.3%	9.7%	4.6%	8.0%	49.4%

Fig. 8. The percentage of diagnosis of patients before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19, fx: fracture)
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3. Etiological distribution of trauma

Falling was the most common cause of trauma in all periods (68.2% BC, 59.0% DC, and 63.3% AC), followed by sports-related injuries.(Fig. 6) The incidence of e-kickboard-related injuries showed an increase from the BC to AC period. Changes were also observed in the types of sports contributing to trauma, with team sports decreasing in the DC period but increasing in the AC period, while individual sports showed the opposite trend. Notably, soccer- and baseball-related traumas, which were nonexistent in the DC period, increased significantly in the AC period. Bicycle and skateboarding traumas showed fluctuating trends across the three periods.(Fig. 7)

4. Trauma incidence while intoxicated

The proportion of patients visiting the hospital for injury sustained while intoxicated remained fairly consistent across all periods.

5. Distribution of injury diagnoses

Lacerations were the most common type of injury in all periods (44.2% BC, 45.3% DC, and 49.4% AC), followed by tooth avulsion and jaw fractures.(Fig. 8) The incidence of subluxation and lateral luxation injuries also varied across the three periods, but the changes were not significant.

IV. Discussion

The results of the present study indicated a decrease in traumatic dental injuries in the DC period. However, the pandemic significantly influenced the overall number of patients and the proportion of injuries from team sports, while variables of sex, age, seasonality, day and time of injury, etiology, and injury diagnosis remained largely consistent. This result indicates persistent characteristics in traumatic dental injuries.

Regarding age demographics, the highest visit frequency was observed in patients <10 years of age, similar to findings in other studies[9-15]. In young children, dental trauma is often attributed to unpredictable behavior and inadequate protective responses in hazardous situations. Notably, children 1-4 years of age experience the highest incidence of dental trauma compared with other ages[10,14,16].

Consistent with previous research, a higher prevalence of male patients was observed in emergency hospital visits[10,13-15]. This disparity is due to the greater involvement of males in high-risk or aggressive activities. However, sex-based analysis in the present study revealed no significant differences in diagnoses (P>0.05).

Seasonally, the highest frequency of visits was in spring, similar to patterns reported in several studies[10,14,15] and attributed to increased outdoor activities as the temperature warms. Reportedly, dental trauma incidents increase during this season[14,15].

In May and June 2020, South Korea implemented a 'distancing in daily life' strategy in response to COVID-19 outbreaks, predominantly linked to bars and restaurants[3]. Following the loosening of these restrictions on October 12, 2020, an increase in injury cases was observed in September and October.(Fig. 1) This trend indicates a shift from indoor/contactless to outdoor/interactive activities as the weather cooled, reflecting a rebound in public engagement post-quarantine.

However, distancing policies were reinstated at Level 2 on November 24, 2020, imposing restrictions on large events and mandating the closure of high-risk venues[3]. Consequently, a downtrend in injury cases was observed in November of the DC period. In December, further escalation to Level 2.5 restrictions[3] led to the lowest number of patient visits to the Emergency Dental Care Center, demonstrating the direct effect of stringent public health measures on injury incidence. (Fig. 1)

The frequency of patient visits to the Emergency Dental Care Center peaked on Fridays, with a notable increase during the weekends. This pattern is in agreement with the operational hours of private clinics in many South Korean cities, which often provide late-night services during weekdays. Consequently, patients experiencing trauma typically manage with painkillers overnight on weekdays and seek emergency care predominantly from Friday night through the weekend when many private dental practices are closed[10]. In addition, increased outdoor activities during weekends may contribute to this trend.

The time from 18:00 to 21:59 was the peak period for Emergency Dental Care Center visits, similar to findings in other studies[10,14]. This pattern occurs because private dental clinics typically close during these hours, leaving patients in need of immediate dental care with no alternative but to seek services at 24/7 emergency centers[10,14].

Despite collection restrictions, the distribution of trauma causes remained consistent. Falling was the most common cause[9], followed by sports-related injuries, traffic accidents, and assaults. A reduction in team sports-related injuries was observed in the DC period, likely due to social distancing measures. Conversely, an increase in assault-related injuries was observed in the DC period, potentially indicative of heightened stress and violence in domestic settings. Sport injuries increased in the DC period and were due primarily to individual sports because group sport activities were limited.

A significant change was observed in the prevalence of injuries from team sports (e.g., soccer, baseball, taekwondo, dodgeball, gymnastics, swimming, badminton, and ballet) compared with individual sports (e.g., cycling, running,

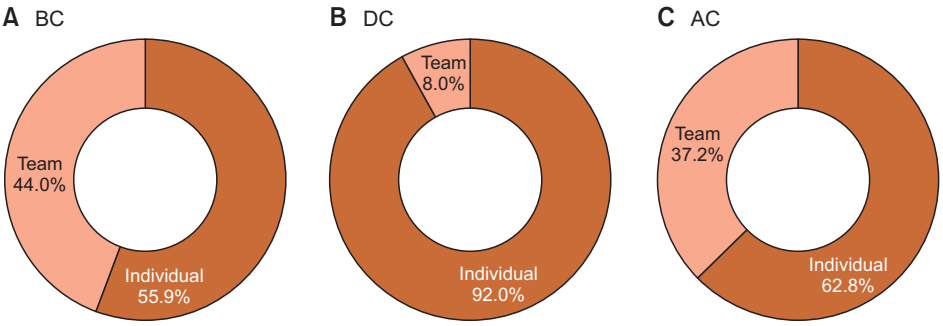

Fig. 9. Characteristic of sports that cause trauma to patients before, during, and after coronavirus disease 2019 (COVID-19). (BC: before COVID-19, DC: during COVID-19, AC: after COVID-19)
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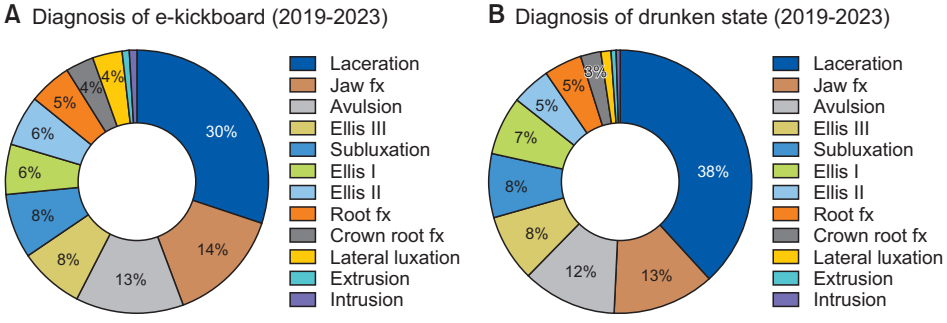

Fig. 10. The percentage of diagnoses for patients with e-kickboard-related trauma and drunken-related trauma. (fx: fracture)
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skateboarding, trampolining, and paragliding) in the DC period.(Fig. 9) This change is attributable to social distancing and assembly restrictions, which substantially affected sports activities and associated injuries[9,17]. Sports such as golf and basketball, which can be categorized as both individual and team activities, showed ambiguous trends and appeared unrelated to the effects of COVID-19.

E-kickboard-related injuries steadily increased. In the BC period, only 2.6% of visits were e-kickboard-related, which increased to 7.5% in the AC period, a nearly 3-fold increase. This trend was particularly pronounced among individuals 20-29 years of age[18]. The majority of e-kickboard injuries was lacerations, followed by tooth avulsions and jaw fractures (Fig. 10), underscoring the potential severity of these incidents and highlighting the need for enhanced safety measures.

Despite restrictions on public gatherings, the incidence of injuries among intoxicated patients remained consistent. The prevalence of intoxication-related injuries did not show significant changes in the BC, DC, or AC periods (P>0.05), indicating that alcohol consumption behaviors were not markedly affected by the restrictions. The majority of intoxication-related injuries was lacerations, followed by tooth avulsions and jaw fractures.(Fig. 10)

Lacerations were the most common injury type, followed by tooth avulsions, jaw fractures, subluxations, lateral luxations, and Ellis III injuries. Tooth dislocations are more frequent than fractures due to the softer nature of alveolar bone, gingiva, and connective tissues compared with teeth. In children, the softer alveolar bone predisposes them to periodontal injuries before tooth fractures. Crown-root fractures, although less common, occur more frequently in individuals >41 years of age[10].

Children's natural curiosity and higher activity levels lead to a greater propensity for collisions and falls[19]. Adolescents and young adults exhibit a higher incidence of injuries from physical altercations. Sports injuries are predominantly observed in children and adolescents, and traffic accidents, although more common in adults, occur across all age groups[10].

V. Conclusion

Although tendencies were observed in the collected data, the results must be carefully interpreted due to the nature of the study, small sample size, and limited study period. However, significant differences were not found between the characteristics and patterns of dental trauma in BC, DC, and AC periods. However, due to the pandemic and the subsequent social distancing, activities decreased and dental trauma-related incidents declined.

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Authors' Contributions

W.J.Y. participated in data collection, performed the statistical analysis, and wrote the manuscript. J.Y.Y. participated in the study design, coordination, and helped to finalized the manuscript. All authors read and approved the final manuscript.

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Ethics Approval and Consent to Participate

Ethical clearance for this research was obtained from the Institutional Review Board of Seoul National University Bundang Hospital (IRB No. B-2205-756-109), and the written informed consent was waived by the IRB due to the retrospective nature of the study.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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