ORIGINAL RESEARCH

Prevalence of Traumatic Dental Injuries to the Anterior Teeth and Associated Factors among 3–5 Years Old Preschool Children in Bhavnagar, Gujarat, India

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Abstract

Background: Other than dental caries, a traumatic dental injury (TDI) is a common trait in youngsters. Dentists face a dilemma when dealing with children who have suffered anterior tooth damage and their worried parents. Only a few research on the frequency of TDIs among preschool children have been undertaken in India. This study aimed to determine the prevalence of TDI in Bhavnagar and the factors that contribute to it.

Materials and methods: In Bhavnagar, Gujarat, India, a cross-sectional study of preschool children aged 3–5 years was undertaken. A single trained examiner screened 1,375 childrens for TDI of the primary anterior teeth. TDIs were assessed and recorded using Andreasen's visual criteria for tooth discoloration and dislocation. Parents of TDI-positive children were asked to complete a proprietary questionnaire about their children's demographics, socioeconomic status, and tooth injury specifics. The prevalence of TDI was correlated with the data supplied by the parents using the Chi-square test.

Results: The prevalence of traumatic TDI to anterior teeth and related variables was 12.29%. There was a statistically significant link between gender and the prevalence of TDI ($p = 0.049$). Enamel fracture was found in 61.3% of cases, while pulp damage was found in 31.5% of cases. The relationship between preschool children's age, gender, zone, and socioeconomic status and the number of teeth involved was shown to be statistically negligible.

Conclusion: Dental trauma was common in children aged 3–5 years old, with a prevalence rate of 12.29%. The primary maxillary left central incisor was the most injured tooth. The mandibular left lateral incisors were the teeth that were least broken. Males had a higher rate of enamel fracture, whereas females had a more considerable prevalence of pulpal injury.

Keywords: Avulsion, Children, Trauma, Wound and injuries.

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Introduction

Besides dental caries, TDI in children is a common occurrence in dentistry.[1] Traumatic oral injuries are frequently linked to facial fractures in road traffic incidents. On the contrary, exclusive dental injuries are commonly caused by minor mishaps such as a fall or contact with blunt items while playing. Parents of children who have had anterior tooth injuries will be more concerned about injury/trauma, posing a challenge to the dentist. Trauma to a tooth causes pulpal hyperemia, which causes congestion and alterations in the blood flow of the pulp, which can lead to irreversible degenerative changes and, in the long run, pulpal necrosis.

Dental injuries can happen at any age, starting as early as the first year of life and progressing as a child learns to crawl, stand, and walk, with a peak occurrence throughout the school years. TDI is most common between 2 and 5 when children are still developing. Because of a lack of coordination and judgment, the odds of acquiring injuries increase as the kid engages in more significant physical activity.[2-4] Dental injuries to the primary teeth can cause developmental defects in the underlying permanent teeth, such as delayed eruption, hypoplasia, tooth discoloration, and tooth malformation.[5] Traumatic injuries harm a child's quality of life due to physical appearance, emotional impact, and speech defect.[6,7]

The literature is divided between the age range and gender of high-risk individuals.[5,8] Maxillary teeth are more typically injured than mandibular teeth. The maxillary central incisors are commonly injured, which is due to their vulnerable position.[9]

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Only a few studies on TDI prevalence among preschool children have been undertaken in India.[10-13] Shekhar and Mohan[12] reported a 6.2% prevalence of injuries among deciduous anterior teeth in a sample of 1,126 preschool childrens in Chennai. Another study conducted by Rai and Munshi involving preschool and school children between the ages of 3 and 16 reported a prevalence of 5.29% of incisors and canine fractures.[11] Chalissery et al. reported a prevalence rate of 10.2% in their study of dental trauma among children aged 3–5 years in a sample of 800 childrens. They also discovered that associated characteristics such as socioeconomic status were not substantially linked to dental trauma in the preschoolers studied.[13]

Only a few studies on TDIs to permanent teeth have been conducted in Gujarat, but none on TDIs to primary teeth. As a result of the limitations of existing data, the current study was carried out to determine the prevalence and associated determinants of anterior dental trauma in primary dentition among 3–5 years old children in Bhavnagar, Gujarat, India.

Materials and Methods

The study, with the reference number CODS/IEC/28/2018, was authorized by the institutional review board. With a 99% confidence interval and a 3.5% margin of error, Morgan's table calculated a sample size of 1,375 people from Bhavnagar's total population of 593,368 people. Preschoolers aged 3–5 years old from various schools were divided into four zones: north zone, south zone, east zone, and west zone. One school was chosen from each zone. The schools gave their permission to screen and record the data in advance. Parents gave their written consent to the screening. Children were inspected with sterile mouth mirrors, straight probes, and cotton at the school under natural daylight. Only the primary maxillary and mandibular teeth were examined during the dental examination. Children with debilitating systemic disease, missing incisors due to caries or physiological exfoliation, children not present on the day of the test, and those who did not return consent forms and completed questionnaires were all eliminated from the study. The Andreasen (2012) criteria for visual assessment of tooth discoloration and displacement of teeth were used to analyze further children who showed clinical indications of TDI (Table 1).[13]

Questionnaires were provided to parents of TDI-positive children; however, because of the pandemic's beginning, the parents could not submit the questionnaire form (COVID-19). As a result, the respected school acquired the email addresses of all 168 TDI-positive children's parents, and the questionnaire's hyperlink was sent as a Google Form (Table 2). A copyrighted questionnaire (L-106818/2021) was created, which includes participants' name, age, gender, school name, child's personality, socioeconomic situation—occupation of the head of the family, education of the head of the family, monthly family income, playful activities, and activity kind. The questioner asked about the type of trauma, the tooth affected, the number of teeth involved, the TDI history—when, what, where, the fate of the TDI, the treatment for the TDI, the time, and the reason for not seeking trauma therapy. The parents were requested to complete and submit the paperwork. One hundred and nine parents answered the Google Form out of 168 TDI-positives. The parents of 59 TDI students did not respond to the Google Form. For an Indian population, the family's socio economic status (SES) was assessed using the Modified Kuppuswamy Scale 2019.[14] A *p*-value of 0.05 was considered significant. The Statistical Package for Social Sciences version 22.0 was used to conduct the statistical analysis.

Table 1: Visual assessment of tooth discoloration and dislocation of teeth by Andreasen (2012)[14]

Code	*Injury*	*Criteria*
0	No injury	No evidence of treated or untreated dental injury.
1	Treated dental injury	Composite restoration, bonding of the tooth fragment, crown, denture, or bridge pontics replacing missing teeth due to TDI, restoration located in the palatal/lingual surface of the crown suggesting endodontic treatment. No evidence of decay or any other treatment provided due to TDI.
2	Enamel fracture only	Loss of small portion of the crown, including only enamel.
3	Enamel/ dentin fracture	Loss of a portion of the crown, including enamel and dentin without pulp exposure.
4	Pulp injury	Signs and symptoms of pulp involvement due to dental injury. It includes fractures with pulp exposure, dislocation of the tooth, presence of sinus tract, and/or swelling in the labial/ lingual vestibule without evidence of caries and discoloration of the crown. The examiner must check if pulp involvement was due to caries (presence of treated/untreated caries lesion).
5	Missing tooth due to trauma	Absence of the tooth due to a complete avulsion. Code 5 should be used only for teeth judged to be missing due to trauma. A positive history of trauma is needed to record missing teeth due to trauma, and the examiner must ask the participant if the avulsion was due to a harmful incident involving the front teeth/ mouth or have been extracted due to caries.
9	Excluded tooth	Signs of traumatic injury cannot be assessed, i.e., presence of appliances or all permanent incisors missing due to caries.

Results

The TDI was found in 12.29% of the 1,375 samples, 15.5% of males and 8.80% of females, respectively (Table 3). Seven of the 3-year-old children tested positive for TDI. The TDI of children aged 4 and 5 was reported to be 26 and 76, respectively (Table 4). Gender and TDI prevalence were shown to have a statistically significant 0.03 correlation. Enamel fracture was found to be prevalent in 61.3% of the population. Similarly, 4.8% of enamel/dentine fractures, 31.5% of pulp injuries, and 2.5% of missing teeth were observed.

There was a significant relationship between oral trauma and socioeconomic characteristics ($p = 0.04$). Similarly, $p = 0.02$ was notable among 3–5 years old. The kids from the upper-middle class had the highest prevalence of TDI, followed by those from the lower-middle class and higher-lower class, lower class, and none from the top class (Table 5).

The teeth on the maxillary left central incisor were the most damaged. The maxillary teeth were more affected than the mandibular teeth. The mandibular left lateral incisors were the teeth that were least damaged. The parents' responses for TDI suggested that the injury occurred more frequently at home. The parents' stated reason for delaying TDI treatment was a lack of knowledge about treatment options (Table 6).

Discussion

Dental trauma is a common occurrence, particularly in children. It usually denotes a severe condition that affects many facets of the patient's life. These injuries can result in soft tissue injuries that heal without indicating the event, or they can result in tooth fractures that leave a permanent record of the injury.[15] There are numerous

Table 2: Google Form consisting of 20 close-ended questionnaire

Sl. no.	*Questioner*
1	Child name
2	School name
3	Child age A. 3 years B. 4 years C. 5 years
4	Sex A. Male B. Female
5	Personality of your child A. Quite B. Boisterous
6	Occupation of the head of the family A. Legislators, senior official & managers B. Professionals C. Technicians and associate professionals D. Clerks E. Skilled workers & shop & market sales workers F. Skilled agricultural & fishery workers G. Plant & machine operators and assemblers H. Unemployed
7	Education of the head of the family A. Profession or honors B. Graduate C. Intermediate or diploma D. High school certificate E. Middle school certificate F. Primary school certificate G. Illiterate
8	Monthly family income in rupees A. >78,063 B. 39,033–78,062 C. 29,200–39,032 D. 19,516–29,199 E. 11,708–19,515 F. 3,908–11,707 G. <3,907
9	Is your child active in playful activities? A. Yes B. No
10	Which type of activity does your child prefer? A. Indoor B. Outdoor
11	Did your child have any trauma to the teeth? A. Yes B. No
12	The number of tooth involved in dental trauma A. Single B. Multiple
13	Tooth involved in trauma A. Upper front tooth region B. Lower front tooth region
14	When did the injury occur? A. Same day B. 1 week C. 1–6 months D. >1 year

Contd…

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Sl. no.	*Questioner*
15	What is the cause for dental trauma to your child? A. Trips and fall B. Accidental collision C. Sports D. Traffic accidents E. Violence or fights F. Do not remember
16	Where did the injury occur? A. Home B. School C. Road side
17	What happened after the dental trauma? A. Pain B. Swelling C. Discoloration of tooth D. Tooth loss E. Bleeding F. Mobility G. Tooth breakage H. Nothing happened
18	If your child had experienced dental trauma was there any dental treatment taken? A. Yes B. No
19	Time elapsed between injury and treatment given? A. 1 week B. 1–6 months C. More than 6 months D. More than 1 year
20	Reason for seeking delayed treatment? A. Personal reason B. Ignorant about treatment modalities C. Importance of milk teeth

Table 3: Total prevalence of traumatic dental injury

Gender	*Samples*	*TDI-positive*	*Prevalence (%)*
Male	739	112	15.15
Female	636	56	8.80
Total	1,375	168	12.29

Table 4: Distribution of TDI-positive sample by gender, age, and zone as per Google Form responses received from parents

	Gender		*School and zone of Bhavnagar city*				
Age in year	*Male*	*Female*	*East zone*	*South zone*	*North zone*	*West zone*	*Total sample of TDI-positive*
3	5	2	1	3	2	1	7
4	17	9	0	6	13	7	26
5	44	32	22	6	40	8	76
Total	66	43	23	15	55	16	109

researches available that investigate various aspects of dental trauma. The most studied characteristics are frequency, etiology, SES, proper treatment approach, and techniques for preventing oral trauma. Another element studied in the literature is the trauma distribution in the 3–5 years old age range. Increased overjet, a small upper lip, incompetent lips, mouth breathing, and class II malocclusion are predisposing factors.[16] Furthermore, most TDI studies focus on permanent teeth, and just a few have investigated primary dentition TDIs. Our research focused on the preschool age group when severe oral injuries are most common, and motor coordination is still developing.

Traumatic dental injury has a complicated and complex etiology. According to Glendor,[17] the principal etiologic variables of TDIs can be divided into three categories: human behavior, oral factors, and environmental determinants. In a cross-sectional study conducted by Chalissery et al. in Jaipur, 57.2% of 3–5 years old children classified as high SES sustained anterior dental trauma, compared to only 42.9% of children classified as low SES.[13] Several

Table 5: Prevalence of dental trauma by four different socioeconomic factors

Socioeconomic factors		*Total (%)*	*p-value*
Gender	Male	66 (60.2%)	0.048*
	Female	43 (39.8%)	
Age	3 years	7 (6.5%)	0.029*
	4 years	26 (24.1%)	
	5 years	76 (69.4%)	
Zone	East	23 (20.4%)	0.37
	South	15 (13.9%)	
	North	55 (50.9%)	
	West	16 (14.8%)	
SES	Upper	0 (0%)	0.697
	Upper middle	49 (45.4%)	
	Lower middle	45 (40.7%)	
	Upper lower	14 (13.0%)	
	Lower	1 (0/9%)	
	Total	109 (99.08%)	

* Statistically significance at 5% level.

studies on TDIs in the primary dentition have found positive associations between increased overjet and the prevalence of maxillary incisor trauma.[18–21] In the primary dentition, one of the leading causes of anterior open bite is non-nutritive sucking habits. A history of nonnutritive sucking is typically related to anterior open bite, increased overjet, class II canine and molar connections, posterior crossbite, and inadequate lip coverage.[22,23]

Traumatic dental injury might range from modest enamel fractures to significant tooth displacement or avulsion damage. In primary teeth, the prevalence of TDI varies from 9.4 to 71.4%,[13] 36.50% of TDIs develop before the age of 10, with the peak occurring between 2 and 4 years.[24]

Shekhar and Mohan[12] discovered an incidence of TDI in Indian preschool children of 6%, which is relatively low compared to our findings. Chalissery et al.[13] found 10.2% TDI to the anterior tooth in research conducted in Jaipur, which agrees with our results. Bhayya and Shyagali[10] in Kalaburagi city discovered 76.13%, significantly higher than our findings. The overall prevalence of TDIs in this group was 12.26% in our study. Researchers used varied diagnostic criteria, sample size, age group under inquiry, and study area to explain the disparity in reported prevalence. In line with the findings of most investigations, the most prevalent traumatic damage was enamel fracture.[11,13,25] In our study, we discovered that 63.6% of males had enamel fracture, 7.6% had enamel/dentin fracture, and 27.3% had pulp injury, respectively. However, of the total female respondents, 59.8% had enamel fracture, 27.3% had pulp damage, and 2.9% had enamel/dentin fracture or missing tooth owing to trauma, respectively.[26] Male participants in this study had a considerably higher rate of dental trauma than female participants.

Males are twice as likely as females to get dental injuries. On the contrary, other studies have found no sex preference in primary dental trauma.[13,27] Crown fractures are the most prevalent type of dental trauma, accounting for 80–90% of all occurrences. Our findings corroborate Correa-Faria et al.[26] observation of a similar pattern of crown fracture with total enamel damage. In the study, there was no link between SES and tooth trauma. Our findings are similar to those of research conducted by Chalissery et al. in Jaipur.[13] Inconsistencies in the relationship between SES and dental trauma in children have been documented by Correa-Faria et al.[26] and Lam.[28]

According to a Brazilian study, the highest years for oral trauma events were between 3 and 4 years.[18] According to Jácomo and Campos,[29] the most typical age for oral trauma is 1–4 years old. Similar findings have been found in youngsters from rural Australia, India, and South Korea.[30–32] According to our results, 33% of respondents reported tooth-breaking because of dental trauma, while 25% reported tooth discoloration. Approximately 7.3% of them have sought dental treatment because of the trauma. In our study, Approximately 7.3% of them had dental care for the trauma, which is greater than the figure reported by Shekhar and Mohan.[12] Dental trauma was common in Indian youngsters, with 1.68% of patients with traumatized teeth receiving treatment.[12]

Tewari et al.[33] conducted a systematic study and meta-analysis on the prevalence of TDIs in India, finding that 13 TDI per 100 people in the Indian population. The frequency of TDI in children aged 6 was 15%, which was slightly higher than our findings. Trauma to the primary teeth might result in permanent dental impairment. Another prevalent issue is enamel discoloration and hypoplasia and the halt of root growth and retention due to ankylosis.[29,34] However, due to a lack of dental awareness, expense, and health access issues, early treatment of dental trauma is rare in Indian children. The worldwide prevalence of TDI to the primary teeth is 22.7% and for permanent teeth is 18.1%.[35] We could not physically distribute the questionnaires to the 168 parents of TDI-positive children during our study due to the rapid advent of the pandemic (COVID-19). However, we could collect data from 109 parents by email, which accounted for our study's shortcoming.

Conclusion

Traumatic dental injuries to the anterior teeth were found in 12.29% of 3–5 years old preschool-aged children in Bhavnagar city.

Table 6: Distribution of Google Form responses for traumatic dental injury

		Percentage of answers					
		Gender		*Age of the child*			
Questions	*Responses*	*Male*	*Female*	*3 years*	*4 years*	*5 years*	*Total*
1. Personality of your child	Quite	45.5%	54.5%	2.3%	22.7%	75.0%	40.4%
	Boisterous	70.8%	29.2%	0.0%	26.2%	73.8%	59.6%
2. Is your child active in playful activities?	Yes	67.0%	33.0%	1.1%	25.0%	73.9%	80.7%
	No	33.3%	66.7%	0.0%	23.8%	76.2%	19.3%
3. Which type of activity does your child prefer?	Indoor	51.6%	48.4%	1.6%	28.1%	70.3%	58.7%
	Outdoor	73.3%	26.7%	0.0%	20.0%	80.0%	41.3%
4. Cause of the injury	Trips and fall	34.8%	34.9%	100.0%	48.1%	29.6%	34.9%
	Accidental collision	6.1%	4.7%	0.0%	7.4%	4.9%	5.5%
	Sports	36.4%	32.6%	0.0%	22.2%	39.5%	34.9%
	Traffic accidents	6.1%	2.3%	0.0%	7.4%	3.7%	4.6%
	Violence or fights	6.1%	9.3%	0.0%	3.7%	8.6%	7.3%
	Do not remember	10.6%	16.3%	0.0%	11.1%	13.6%	12.8%
5. When did the injury occur?	Same day	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	1 week	4.5%	2.3%	0.0%	0.0%	4.9%	3.7%
	1–6 months	68.2%	58.1%	100.0%	66.7%	63.0%	64.2%
	>1 year	27.3%	39.5%	0.0%	33.3%	32.1%	32.1%
6. Where did the injury occur?	Home	48.5%	30.2%	100.0%	59.3%	41.3%	41.3%
	School	34.8%	46.5%	0.0%	18.5%	39.4%	39.4%
	Roadside	16.7%	23.3%	0.0%	22.2%	19.3%	19.3%
7. What happened after the dental trauma?	Pain	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
	Swelling	0.00%	0.00%	0.00%	0.00%	0.00%	0.0%
	Discoloration of tooth	24.2%	25.6%	0.0%	25.9%	24.7%	25%
	Tooth loss	3.0%	4.7%	0.0%	3.7%	3.7%	3.7%
	Bleeding	0.00%	0.00%	0.00%	0.00%	0.00%	0%
	Mobility	0.00%	0.00%	0.00%	0.00%	0.00%	0%
	Tooth breakage	34.8%	30.2%	100.0%	33.3%	32.1%	33%
	Nothing happened	37.9%	39.5%	0.0%	37.0%	39.5%	38.5%
8. Was there any dental treatment taken?	Yes	4.5%	11.6%	0.0%	3.7%	8.6%	7.3%
	No	95.5%	88.4%	100.0%	96.3%	91.4%	92.7%
9. Time lapsed between injury and treatment given	1 week	3.0%	7.0%	0.0%	3.7%	4.9%	86.2%
	1–6 months	1.5%	4.7%	0.0%	0.0%	3.7%	4.6%
	More than 6 months	6.1%	7.0%	0.0%	3.7%	7.4%	2.8%
	More than 1 year	0.00%	0.00%	0.00%	0.00%	0.00%	0%
10. Reason for seeking delayed treatment	Personal reason	33.3%	27.9%	100.0%	40.7%	27.2%	31.2%
	Ignorant about treatment modalities	43.9%	58.1%	0.0%	40.7%	53.1%	49.5%
	Importance of milk teeth	22.7%	14.0%	0.0%	18.5%	19.8%	19.3%

TDI was shown to be more prevalent in boys than in girls. Males had more enamel fractures, whereas females had more pulpal injuries. The majority of the TDI took place in people's homes. The top middle and lower classes had higher TDI than the lower middle and lower classes. Due to a lack of information on trauma management, 92.7% of people did not seek dental treatment after taking the TDI.

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References

1. Andreasen JO, Andreasen FM, Andreason L. Traumatic Injuries to the Teeth. 4th ed. Denmark: Blackwell Publishing Ltd; 2007.
2. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1,298 cases. Scand J Dent Res 78(4):329–342. DOI: 10.1111/j.1600-0722.1970.tb02080.x
3. Andreasen JO, Ravn JJ. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. Int J Oral Surg 1972;1(5):235–239. DOI: 10.1016/s0300-9785(72)80042-5
4. Andreasen JO. Traumatic Injuries of the Teeth. 2nd ed. Philadelphia: W.B. Saunders Co; 1981.
5. Bijella MF, Yared FN, Bijella VT, et al. Occurrence of primary incisor traumatism in Brazilian children: a house-by-house survey. ASDC J Dent Child 1990;57(6):424–427.
6. Aldrigui JM, Jabbar NS, Bonecker M, et al. Trends and associated factors in prevalence of dental trauma in Latin America and Caribbean: a systematic review and meta-analysis. Community Dent Oral Epidemiol 2014;42(1):30–42. DOI: 10.1111/cdoe.12053
7. Cardoso M, de Carvalho Rocha MJ. Traumatized primary teeth in children assisted at the Federal University of Santa Catarina, Brazil. Dent Traumatol 2002;18(3):129–133. DOI: 10.1034/j.1600-9657.2002.00030.x
8. Ferreira JM, Fernandes de Andrade EM, Katz CR, et al. Prevalence of dental trauma in deciduous teeth of Brazilian children. Dent Traumatol 2009;25(2):219–223. DOI: 10.1111/j.1600-9657.2008.00754.x
9. Beltrao EM, Cavalcanti AL, Albuquerque SS, et al. Prevalence of dental trauma children aged 1–3 years in Joao Pessoa (Brazil). Eur Arch Paediatr Dent 2007;8(3):141–143. DOI: 10.1007/BF03262583
10. Bhayya DP, Shyagali TR. Traumatic injuries in the primary teeth of 4- to 6-year-old school children in Gulbarga city, India. A prevalence study. Oral Health Dent Manag 2013;12(1):17–23.
11. Rai SB, Munshi AK. Traumatic injuries to the anterior teeth among South Kanara school children – a prevalence study. J Indian Soc Pedod Prev Dent 1998;16(2):44–51.
12. Shekhar MG, Mohan R. Traumatic dental injuries to primary incisors and the terminal or occlusal plane relationship in Indian preschool children. Community Dent Health 2011;28(1):104–106.
13. Chalissery VP, Marwah N, Jafer M, et al. Prevalence of anterior dental trauma and its associated factors among children aged 3–5 years in Jaipur City, India–a cross sectional study. J Int Soc Prevent Community Dent 2016;6(Suppl 1):S35–S40. DOI: 10.4103/2231-0762.181165
14. Saleem SM. Modified Kuppuswamy socioeconomic scale updated for the year 2019. Indian J Forensic Community Med 2019;6(1):1–3. DOI: 10.18231/2394-6776.2019.0001
15. Nik-Hussein NN. Traumatic injuries to anterior teeth among school children in Malaysia. Dent Traumatol 2001;17(4):149–152. DOI: 10.1034/j.1600-9657.2001.170402.x
16. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. Aust Dent J 2000; 45(1):2–9. DOI: 10.1111/j.1834-7819.2000.tb00234.x
17. Glendor U. Aetiology and risk factors related to traumatic dental injuries – a review of the literature. Dent Traumatol 2009; 25(1):19–31. DOI: 10.1111/j.1600-9657.2008.00694.x
18. Feldens CA, Kramer PF, Ferreira SH, et al. Exploring factors associated with traumatic dental injuries in preschool children: a poisson regression analysis. Dent Traumatol 2010;26(2):143–148. DOI: 10.1111/j.1600-9657.2009.00858.x
19. Piovesan C, Guedes RS, Casagrande L, et al. Socioeconomic and clinical factors associated with traumatic dental injuries in Brazilian preschool children. Braz Oral Res 2012;26(5):464–470. DOI: 10.1590/s1806-83242012000500014
20. Goettems ML, Azevedo MS, Correa MB, et al. Dental trauma occurrence and occlusal characteristics in Brazilian preschool children. Pediatr Dent 2012;34(2):104–107. DOI: 10.1590/1807-3107
21. Bonini GC, Bönecker M, Braga MM, et al. Combined effect of anterior malocclusion and inadequate lip coverage on dental trauma in primary teeth. Dent Traumatol 2012;28(6):437–40. DOI: 10.1111/j.1600-9657.2012.01117.x
22. Ngan P, Fields HW. Open bite: a review of etiology and management. Pediatr Dent 1997; 19(2):91–98.
23. Kohler L, Holst K. Malocclusion and sucking habits of four-year-old children. Acta Paediat Scand 1973; 62(4):373–379. DOI: 10.1111/j.1651-2227.1973.tb08122.x
24. Adair SM, Milano M, Lorenzo I, Russell C. Effects of current and former pacifier use on the dentition of 24- to 59-month-old children. Pediatr Dent 1995;17:437–444.
25. Vejdani J, Fathollah SP, Leyli EK. Prevalence of traumatic injuries to the anterior primary teeth in preschool children in Rasht, Guilan, 2012. J Dentomaxillofac Radiol Pathol Surg 2014;10(4):23–28. DOI: 10.18869/acadpub.3dj.2.4.23
26. Corrêa-Faria P, Martins CC, Bönecker M, et al. Clinical factors and socio-demographic characteristics associated with dental trauma in children: a systematic review and meta-analysis. Dent Traumatol 2016;32(5):367–378. DOI: 10.1111/edt.12268
27. Cunha RF, Pugliesi DM, de Mello Vieira AE. Oral trauma in Brazilian patients aged 0–3 years. Dent Traumatol 2001;17(5):210–212. DOI: 10.1034/j.1600-9657.2001.170504.x
28. Lam R. Epidemiology and outcomes of traumatic dental injuries: a review of the literature. Aust Dent J 2016;61(Suppl 1):4–20. DOI: 10.1111/adj.12395
29. do Espírito Santo Jácomo DR, Campos V. Prevalence of sequelae in the permanent anterior teeth after trauma in their predecessors: a longitudinal study of 8 years. Dent Traumatol 2009;25(3):300–304. DOI: 10.1111/j.1600-9657.2009.00764.x
30. Norton E, O'Connell AC. Traumatic dental injuries and their association with malocclusion in the primary dentition of Irish children. Dent Traumatol 2012;28(1):81–86. DOI: 10.1111/j.1600-9657.2011.01032.x
31. Choi SC, Park JH, Pae A, et al. Retrospective study on traumatic dental injuries in preschool children at Kyung Hee Dental Hospital, Seoul, South Korea. Dent Traumatol 2010; 26(1): 70–75. DOI: 10.1111/j.1600-9657.2009.00840.x
32. Yagot KH, Nazhat NY, Kuder SA. Traumatic dental injuries in nursery schoolchildren from Baghdad, Iraq. Community Dent Oral Epidemiol 1988;16(5):292–293. DOI: 10.1111/j.1600-0528.1988.tb01778.x
33. Tewari N, Mathur VP, Siddiqui I, et al. Prevalence of traumatic dental injuries in India: a systematic review and meta-analysis. Indian J Dent Res 2020;31(4):601–614. DOI: 10.4103/ijdr.ijdr_953_19
34. Sennhenn-Kirchner S, Jacobs HG. Traumatic injuries to the primary dentition and effects on the permanent successors – a clinical follow-up study. Dent Traumatol 2006;22(5):237–241. DOI: 10.1111/j.1600-9657.2006.00383.x
35. Petti S, Glendor U, Andersson L. World traumatic dental injury prevalence and incidence, a meta-analysis—one billion living people have had traumatic dental injuries. Dent Traumatol 2018;34(2):71–86. DOI: 10.1111/edt.12389